PHOTOGRAPHY FOR ALL:

AN ELEMENTARY TEXT BOOK

AND INTRODUCTION

TO THE ART OF TAKING PHOTOGRAPHS.

BY

W. JEROME HARRISON, F.G.S.,

AUTHOR OF

"A History of Photography." *"The Geology of England and Wales,"* etc., etc.,

AND EUROPEAN EDITOR OF

"The International Annual of Anthony's Photographic Bulletin."

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For full Contents see page vii. at end. A four-page Index to this work will be sent gratis and post free on application.

AN INTRODUCTION TO THE SCIENCE & PRACTICE OF PHOTOGRAPHY.

BY

CHAPMAN JONES, F.I.C., F.C.S.,

Demonstrator of Practical Chemistry in the Normal School of Science and Royal School of Mines, Member of the Photographic Society of Great Britain, &c.

PRESS OPINIONS.

"One of the most comprehensive treatises on photography that we have had occasion to notice for some time."—*British Journal of Photography.*

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PREFACE.

IN the history of photography—which celebrates its jubilee in 1889—three distinct stages can be traced.

In the first of these, which lasted from 1839 to 1851, its sphere was extremely restricted. The practice of the daguerreotype process, by which pictures were taken on silvered plates, was restricted to a few professionals.

In its second epoch, from 1852 to 1878, the collodion process held sway, and professional photography became familiar as an art.

But with the introduction of the now universally used gelatine dry-plates about 1879, photography became possible to almost everyone as a recreation; while its powers in other directions were so greatly extended that it is now the recognised handmaid of the arts and sciences.

And whereas during the first decade of its existence photographers were numbered by tens, and even for the next quarter of a century by hundreds only, the camera now numbers its votaries by the thousand, and has become as familiar an object as the barrel-organ or the concertina!

An American author has declared the practice of modern photography to be "as easy as falling off a log!" And it is perhaps not more difficult to take a bad photograph than to make a pun—but either feat is to be deprecated; and the production of *good* photographs calls for the highest qualities of the scientist and the artist.

In several of our large towns there is now a "School of Photography," and the beginner, or the "improver," cannot do better than attend such institutions. Next to

such an advantage would be practical instruction received from some professional or expert amateur.

By all means, too, belong to the nearest Photographic Society.

But in all cases some text-book of the subject will be found necessary, and the author has relied on his thirty years' experience as a teacher and a lecturer to assist him in preparing an elementary work which should be straightforward, simple, and easily understood, while embracing at the same time the best and latest methods.

As a companion to the present work, "The Photographer's Indispensable Handbook," by Sturmey and Welford, will be found of great service, as it gives diagrams, with prices, etc., of almost every piece of photographic apparatus. Those who wish to penetrate more deeply into the chemical side of photography will find "The Science and Practice of Photography," by Chapman Jones, an excellent book. Lastly, let every worker subscribe to one of the weekly journals of photography.

Two of the cardinal virtues of the photographer are *patience* and *order*. With the impatient, hurried worker, nothing goes right; while the disorderly one (he may be known by the state of his dark-room) is generally slovenly, and a producer of dirty, "half-done" work.

The professional has his daily bread to earn; but the amateur is more free, and has more time to experiment. Let each "aim high," and endeavour by continual study and effort to produce something worthy of the beautiful art, the fascinating science, which claims his allegiance.

W. JEROME HARRISON.

365, Lodge Road, Hockley, Birmingham.

September, 1888.

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CHAPTER I.

Photography and its History.

1.—**Definition of Photography.**—Photography is the art of depicting objects by means of the chemical action of light upon certain substances, principally compounds of the metal silver with the non-metals bromine, chlorine and iodine.

2.—**Chemical Action of Light.**—The way in which light affects many kinds of matter must have been noticed in very early times, although we have only of late years been able to discover and explain the manner in which it acts. Many coloured bodies when exposed to sunlight change in colour, or fade, in a few days, or even hours. In this way it is quite possible to copy an opaque object in outline by placing it upon a common brightly-coloured pink ribbon and leaving it in the sun; the part protected from the light will retain its natural colour, while the surrounding portions will fade under the influence of the sun's rays. Even in the skin of the human body we have direct evidence of the power of light, for it becomes bronzed and tanned by exposure; indeed, it is probable that were a race of white-skinned people transported to the tropics the cuticle of their descendants would in time be found to gradually darken in hue until it rivalled that of the Malay or the Negro.

This, then, is one of the great facts which underlies the whole science and art of photography. *Light acts chemically upon many substances—markedly upon certain compounds of silver—and produces changes which are revealed by the different colour of the new substances produced.*

The change of colour produced by the action of light upon the compounds of silver employed in photography is from white to dark purple or black.

3.—**Action of Light upon Silver Chloride.**—To illustrate this change, suppose we dissolve a little common salt in a glass of water, and then add to it a few grains of silver nitrate. Instantly a *white* substance is formed, which is called silver chloride; it is a compound of the two elements, silver and chlorine. Now stand the glass in the sunshine, and the white compound will gradually blacken. What is the cause of this blackening? It has been explained in many ways, but the simplest explanation is that the action of the rays of light has been to *separate* the silver from the chlorine. Now chlorine is a gas which becomes dissolved in the water; but metallic silver, when in the state of extremely fine powder, is *black;* and it is to this deposit of black finely-divided silver that the dark colour is due. In exactly the same way light acts upon silver bromide (separating it into black silver and bromine) and upon silver iodide (which it separates into black silver and iodine).

4.—**Early History of Photography: Wedgwood and Davy.**—Looking back two or three centuries, we find recorded certain facts which show that even then a few men had noticed the changes produced by light in the colour and properties of certain kinds of matter; but these workers—the alchemists—neither attempted to explain these changes, nor to put them to any practical use. Towards the close of the eighteenth century, Thomas Wedgwood, a son of the great potter, tried many experiments with sheets of paper, or of white leather coated with nitrate of silver. He placed flat opaque objects upon such sheets, and then exposed them to light. The light blackened the exposed parts, and so a correct outline of the opaque body was obtained. The famous chemist, Sir

Humphrey Davy, assisted Wedgwood, and found that chloride of silver was even better than the nitrate. When objects of varying degrees of opacity, such as ferns, engravings, etc., were laid upon the prepared paper, very beautiful copies were obtained.

5.—**Wanted, a Fixing Process.**—There was but one thing wanting to render this process, invented by Wedgwood and Davy, "as useful as it is elegant." When the copies obtained were examined, the same light which produced them now obliterated them, reducing the entire surface of the paper to one uniform dark or black tint. Davy tried several ways of "fixing" the sun-pictures, as by washing them in water, varnishing, etc., but without success. He wrote an account of his own and Wedgwood's researches, which was published in 1802.

6.—**A Patient Frenchman: Joseph Nicephore Niépce.**—The first man to secure a permanent photograph was a Frenchman named Niépce, who lived at Chalons-sur-Saone. He used asphalte dissolved in petroleum, with which he coated plates of metal or glass. These plates were then exposed to sunlight beneath the engravings which it was desired to copy; impressions of external objects were also secured in the camera. The light had a chemical effect upon the asphalte, rendering it *insoluble* in petroleum. The consequence was that, when the plate was subsequently washed with that liquid, only the parts of the asphalte which had been protected from light were dissolved away, and thus a *fac-simile* of the original drawing or object was produced. Niépce gave the name of *heliography* to this process; and he worked at it with unwearied patience from 1816 till his death in 1833. The chief defect, which he was unable to overcome, was the *slowness* of the method; the time required to secure a picture in the camera being measured by hours. Niépce recognised this fault so clearly that he never even published any account of his discovery, preferring to wait, in the hope that he could perfect it. In the year 1829 Niépce entered into partnership with another Frenchman named Daguerre. The merits of Niépce were somewhat tardily recognised by the erection of his statue at Chalons in 1885.

7.—**Daguerre Makes Photography a Commercial Success.**—L. J. M. Daguerre continued to work at photography after the death of Nièpce, and in 1839 he announced his success, and divulged his method to the world, being awarded a pension by the French Government. In daguerreotype, as it was styled, silver plates coated with iodide of silver were employed. After an exposure in the camera for a few minutes the picture was brought out or developed by holding the silver plate over some warm mercury. The mercury vapour adhered only to those parts of the plate on which light had acted, and thus the picture became visible. Now, for the first time, portraiture by photography became possible. The daguerreotype process attained considerable popularity, and was largely worked from 1839 to 1853, or thereabouts. Daguerreotypes are now, however, hardly known, except as curiosities. Daguerre "fixed" his first pictures by washing them in a solution of common salt or of potassium bromide, but he abandoned these for hyposulphite of soda immediately Herschel made known the powers of this last-mentioned substance.

8.—**Fox-Talbot Takes Photographs on Paper.**—While Daguerre had been working in France, an Englishman of noble family, named Henry Fox-Talbot, had been making rapid progress in the same direction in England, and his success was announced simultaneously with that of Daguerre. Talbot used at first chloride, and afterwards (1841) iodide of silver spread upon paper, and he called his method the Calotype process. The picture was developed by the aid of a mixture of gallic acid and nitrate of silver. From 1843 to 1855, or thereabouts, this calotype process was practised by many—chiefly amateurs—in England. Hyposulphite of soda as a fixing agent was introduced by Sir John Herschel in 1839.

9.—**Scott-Archer Discovers the Collodion Process.**—Herschel used glass plates on which to spread the sensitive salts of silver as early as 1839. But some substance is needed to hold these compounds, and to cause them to adhere to the glass. For this purpose a Frenchman named Nièpce de St. Victor used albumen

(white of egg) in 1847. But collodion was found by Scott-Archer in 1851 to be much better. Archer also introduced pyrogallic acid as a developer. In the collodion process the glass plate was coated with a delicate film of collodion, containing an iodide, or an iodide and a bromide. The plate was then "sensitised" by dipping it into a bath of silver nitrate, and was exposed, while still wet, in the camera; it was usually fixed by immersion in a solution of that very poisonous substance cyanide of potassium. The collodion process was a great improvement on all that had gone before, and it held the leading place in photography from 1851 to 1880.

10.—**Collodion Dry Plates.**—The collodion "wet-plate" process was a fairly convenient one for use in the studio (although the continual contact with nitrate of silver in solution caused the fingers of the operator to become of inky blackness); but for field work the quantity of apparatus to be carried—including a tent in which to develop the picture, a "bath" or vessel full of nitrate of silver solution, etc.—made its practice a "burden grievous to be borne."

To remedy in part these defects, and enable development to be performed subsequently at home, *collodion dry plates with the bath* were introduced in 1855, and were largely used by tourists and amateurs during the next ten years. The "Hill-Norris plate"—made in accordance with a process discovered by Dr. Hill-Norris, of Birmingham—was manufactured in large quantities, and was the first dry plate placed commercially upon the market. In these "dry-plate processes with the bath" the plates were well washed in water after sensitising in the bath of silver nitrate; they were then coated with a "preservative," such as tannin (Major Russell, 1862), gum and gallic acid (Manners Gordon, 1868), or albumen and beer (Captain Abney, 1874), and allowed to dry spontaneously. These plates were rather slow (requiring, say, twice the exposure needed for wet plates). Some silver nitrate solution was added to the developer employed (which might be any of those in common use) to replace that washed off the plate previous to drying it.

11.—**Photography with Emulsions.**—In 1853 a Parisian photographer named Gaudin mooted the idea of a liquid sensitive to light, with which plates might be coated and then dried and put away ready for use. This idea was realised in 1864 by Messrs. Sayce and Bolton, of Liverpool, who prepared a collodio-bromide emulsion, *i.e.*, liquid collodion containing finely-divided bromide of silver. Dry plates prepared according to this plan were much used by tourists, but they did not displace the "wet" collodion process because they required a longer exposure.

12.—**Dr. Maddox Introduces Gelatine.**—In 1871 Dr. R. L. Maddox made dry plates coated with gelatine containing bromide of silver—a gelatine emulsion, in fact. The method was slowly perfected by Burgess, Kennett, Bennett, and others, and in 1879 it began to displace collodion for general use. It was more convenient and more rapid, and the result has been that since—say 1881—collodion has been abandoned for ordinary photographic work, and we all use gelatine dry plates instead.

13.—**Advance in Rapidity.**—Other things being equal, the process which will take a photograph in the *least space of time* is considered the best. The advance in this direction will be seen from the following table, in which is given the average length of time required by each process to secure a good picture :—

PROCESS.	DATE OF DISCOVERY.	TIME REQUIRED.
Heliography	1827	6 hours.
Daguerreotype	1839	30 mins.
Calotype	1841	3 ,,
Collodion (Wet)	1851	10 secs.
Collodion Emulsion Dry Plates..	1864	15 ,,
Gelatine Emulsion Dry Plates ..	1878	1 ,,

CHAPTER II.

Photographic Apparatus for the Production of Negatives: (a) Indispensable Apparatus.

14.—**What is a "Negative"?**—Suppose we wish to take a picture of a whitewashed cottage surrounded by black tarred palings. The light is reflected powerfully from the white walls, and will produce a powerful impression upon the sensitive surface of the gelatine dry plate we are going to employ. The result will be the production of a black deposit of silver upon that part of the plate where the image of the cottage (produced by the lens) falls. But the black palings reflect scarcely any light, and their image will consequently make scarcely any impression on the gelatine plate. The final result will be that when the finished picture on the glass is held between the eyes and the light, we shall see a black image of the cottage surrounded by white palings. Everything is reversed; black is white, and white is black. For this reason, Sir John Herschel, in 1840, gave to such impressions the name of "negatives." A portrait negative has a somewhat ludicrous appearance. The shirt-front and collar are intensely black—they are the "high lights" of the original subject; they reflected most light, and consequently produced the greatest amount of black or reduced silver—the face, too, appears mostly of a dark grey tint, but the black whiskers and hair are white as those of a patriarch, for they reflected but little light, and consequently their image produced but little effect upon that part of the sensitive plate upon which it fell.

15.—**Essential Apparatus.**—There are seven articles which may fairly be considered as indispensable

in the ordinary practice of photography for the securing of a negative. The list is as follows :—

Camera.
Lens.
Stops or Diaphragms.
Dark Slides.
Sensitive Plates.
Tripod Stand, with head or top, and screw.
Focussing Cloth.

We will describe these essential articles first ; and afterwards consider those which will be useful, but which can be done without if need be.

16.—**The Camera.**—Now, the first essential for the production of a negative such as we have described above is a *camera*. A camera is simply a dark box, having a lens at one end and a piece of ground glass at the other. Many a great photographer has begun his career with a camera made out of an old cigar-box, to which he fitted a spectacle lens, costing perhaps three-halfpence. But we strongly recommend the purchase of a sound, well-made instrument. Generally it is best to buy one's tools *new*, from a respectable firm, and this is especially the case in photography. An adept *may* pick up apparatus really cheap at second-hand ; but even then there are many defects which cannot be discovered until the instruments have been for some time in actual use.

The camera should be made of well-polished mahogany. The bellows, by which the back and front are connected, ought to be of thin leather. The part of the front which carries the lens should "rise" a couple of inches so as to permit of the elevation of the lens when required. The back should have a vertical swing, so that the top may be brought either nearer to or further from the lens than the bottom when necessary. The distance of the back from the front is altered either by a rack placed at the side of the camera, or by a screw at the end. For cameras up to whole-plate size the rack is to be preferred.

Above all things, the camera must be *light-tight*. There must be no pin-holes or cracks in it of any kind. The ground-glass screen may either be hinged to the back so as to fold over when not in use, or it may be made to take

out altogether. If the glass screen gets broken it may be replaced in an emergency by a wetted white handkerchief, or by a square of plain glass dabbed over with putty or smeared with olive oil.

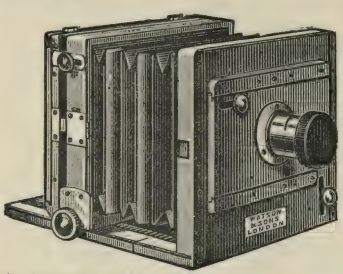

Fig. 1.—Camera with bellows body; side or rack movement; swing-back; and adjustable front.

The bellows should be capable of extension to at least twice the length of the longest side of the plate employed; *i.e.*, for 10 by 8 plates the extension should not be less than 20 inches. If it will "rack out" to three times this length so much the better. A "long-focus" camera is useful for many special objects. The beginner should practise setting up and manipulating his camera in private, until he is familiar with its every movement, before he puts it into actual use.

17.—**Size of Apparatus.**—All sizes of photographic apparatus are governed by the sizes of the gelatine dry plates intended to be used in them. From the earliest times of photography it has been the custom to take pictures on plates of the following sizes:—

NAME.	LENGTH. IN.		BREADTH. IN.	AREA. SQ. IN.
Lantern Size ..	$3\frac{1}{4}$	×	$3\frac{1}{4}$ ..	$10\frac{1}{2}$
Quarter ($\frac{1}{4}$) Plate ..	$4\frac{1}{4}$	×	$3\frac{1}{4}$ ..	$13\frac{3}{4}$
One-third ($\frac{1}{3}$) Plate ..	5	×	4 ..	20
Half ($\frac{1}{2}$) Plate ..	$6\frac{1}{2}$	×	$4\frac{3}{4}$ ..	$30\frac{7}{8}$
..	7	×	5 ..	35
Stereoscopic ..	$7\frac{1}{2}$	×	5 ..	$37\frac{1}{2}$
..	8	×	5 ..	40
Whole ($\frac{1}{1}$) Plate ..	$8\frac{1}{2}$	×	$6\frac{1}{2}$ ..	$55\frac{1}{4}$
..	9	×	7 ..	63
..	10	×	8 ..	80
..	12	×	10 ..	120
..	15	×	12 ..	180

Still larger sizes are often made, including 18 by 16, 20 by 16, 24 by 20, etc.

For a beginner we recommend the quarter-plate size. It is cheap, inexpensive in working, and will always be useful for taking lantern pictures, and for use (cased in a light black box) as a "detective" camera. The pictures taken with it can also be enlarged to double or treble their original size, if desired.

After a year's experience a whole-plate camera may be bought, and this is about the largest size which can be comfortably carried in the field. For studio and professional work the requirements are, of course, entirely different. If the beginner means to adopt one size, and stick to it, then a half-plate camera will be found the most generally useful.

It will be necessary that the camera should admit of the plate being exposed either horizontally or vertically. This is best done by what is known as a "reversing back." The interior of the camera, of the lens-tube, of the dark-slide, and, indeed, of every part which could possibly reflect light upon the sensitive plate ought to be of a *dead black*. By use the edges of the brass stops, of the brass rings round the lenses, etc., become worn and bright, and the light reflected from them may fog the plate, or, at all events, lessen the brilliancy of the picture. All such parts should be reblacked immediately.

18.—**Dark Slides.**—The dark slide is used for carrying the sensitive plates. It should be made of the same wood as the camera, and should fit exactly in the place usually occupied by the ground glass. For out-of-door work each dark slide is usually made "double," *i.e.*, each will carry two plates inserted back to back with a division of blackened metal or card between them. To each camera there ought to be at least three double dark slides, which gives an allowance of six dry-plates without changing. Each double dark-slide should be plainly *numbered* on each side, the lower number being placed on that side of the slide which contains the loose plate, *i.e.*, the plate which will be taken out first when the dark-slide is opened. Thus, with three double-backs or dark-slides the numbers will run from one to six.

19.—**The Lens.**—It is *possible* to do without a lens, using instead a "pin-hole" made in a piece of tinfoil, pasted over an aperture in the front of the camera, and giving an exposure of five or ten minutes. For all practical purposes, however, a lens is absolutely necessary; and, if possible, at least two lenses having different foci should be provided for each camera.

For general all-round work there is no lens to equal that which is known under many names as the Rectilinear, Symmetrical, Doublet, Rectigraph, Autograph, True View,

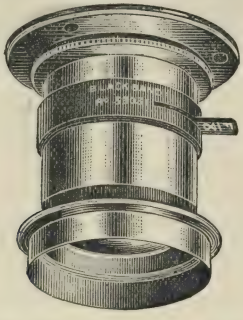

Fig. 2.—Rectilinear lens, with Waterhouse stop in diaphragm.

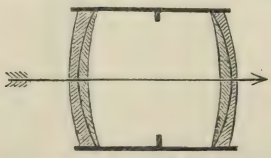

Fig. 3.—Diagram showing the arrangement of the four distinct lenses (two at each end of the lens tube) which constitute an ordinary rectilinear lens. The arrow shows the direction of a ray of light.

Orthopanactinic, etc., etc. Its great advantage is that it gives undistorted pictures. It consists of two lenses placed one at each end of a piece of brass tubing. Midway between the lenses is a slit in the tube, into which the "stops" (presently to be described) are dropped. Some lenses of this class, however, have rotating stops, while others are fitted with an arrangement called the iris

diaphragm. Besides an ordinary lens of this class it is well to have a "wide-angle" lens. The latter will take in

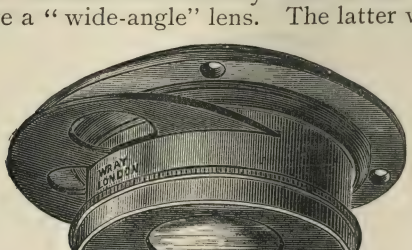

Fig. 4.—Wide-angle rectilinear lens (full-size), showing rotating diaphragm pierced with holes (stops) of varying diameters.

about double the field of view of the ordinary lens, and in confined situations—as narrow streets, etc.—this is a great advantage.

The "Landscape" lens is a single lens, in appearance at all events. All these apparently "single" lenses used in photography are in reality composed of two or three lenses cemented together, and this is one cause of their expense.

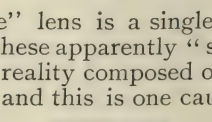

Fig. 5.—Arrangement of the three simple lenses which constitute a single achromatic landscape lens. The arrow shows the direction in which a ray of light would pass through the lens when in its place on the camera.

Landscape lenses can also be used for portraiture, but not for architectural subjects, as the straight lines of houses, etc., anywhere near the edges of the plate are distorted by the lens, and are shown as curves. With each lens is always sold a lens-cap or cover made of morocco leather lined with black velvet. This "cap" should fit well, but not tightly, or we may shake the camera when uncapping the lens. A hole should be bored through the centre of the lens-cap, and by a piece of silk cord the cap can then be

fastened to the lens-tube. This will prevent any chance of the cap being lost, mislaid, or left behind.

20.—**Lenses Specially Constructed for Taking Portraits.**—"Portrait" lenses are the largest and most expensive of all. In the old wet collodion days they were very useful for the purpose implied by their name, because by their aid a portrait could be secured on

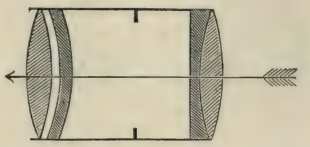

Fig. 6.—Arrangement of the four lenses which constitute an ordinary portrait lens. The arrow shows the direction of the light. There is an air-space between the two back lenses.

even a collodion plate in a few seconds. But the greatly increased rapidity of our gelatine dry plates has in a great measure obviated the necessity for these special portrait lenses; in fact, ordinary rectilinear or even landscape lenses will take very good portraits if skilfully used.

21.—**Stops or Diaphragms.**—The greater the diameter of the lens the more light is admitted, the more brilliant does the image appear on the ground glass, and the more rapidly can the picture be taken. But—and to everything there is a but—when a lens is used with open aperture, *i.e.*, without a stop, only one plane of the picture will be sharply defined; all the rest will be "out of focus," or "fuzzy." To remedy this, stops or diaphragms are used. Those most commonly employed are called (after the inventor) Waterhouse diaphragms, and consist of thin metal plates, each having a circular aperture in the centre. Each lens ought to have four or five of these diaphragms, the holes being of varying size. When one of these stops is inserted in the diaphragm slit, the picture on the ground glass is not so brilliant, but near and distant objects are both in better focus, *i.e.*, are more sharply defined.

Every photographer ought to ascertain the focal length of his lens, which can be done by focussing some distant

object and then measuring the distance from the lens to the ground glass (with a single lens), or from the diaphragm slit to the ground glass (with a doublet lens). With a whole-plate doublet lens the focal length is usually about ten or eleven inches; let us suppose it to be ten inches. The diameter of the clear glass of such a lens may be two inches. Dividing ten by two we get five, and this is written—focal length (10) divided by aperture (2) equals 5; or, more briefly, $\frac{10}{2} = \frac{f}{5}$. This number $\frac{f}{5}$ expresses clearly to a photographer the *rapidity* of the lens. Now carefully measure the diameters of the holes in the four stops with which the whole-plate lens is supplied, and let us suppose these to be one inch, half an inch, quarter of an inch, and one-sixth of an inch respectively. Divide the focal length (10 inches) by each of these numbers in turn, and we obtain $\frac{f}{10}$, $\frac{f}{20}$, $\frac{f}{40}$, and $\frac{f}{60}$.

Other systems of marking stops are in use, but we strongly recommend every photographer to ascertain correctly and once for all the ratios given above, and to engrave each upon its stop.

22.—**Use of Stops.**—It requires some judgment to select the stop best suited to each subject. For portrait or instantaneous work a large stop, or even the full aperture of the lens, must be employed. While for interiors, where we desire microscopic detail, and that objects near to, and others far distant from the lens, shall both be clearly defined, $\frac{f}{60}$ will not be too small a stop to employ if the place be fairly well lighted. For general landscape work $\frac{f}{30}$ is a very suitable stop. Stops are often lost or mislaid, but it is easy to improvise new ones out of cardboard or brown paper. Some lenses are provided with a rotating diaphragm carrying a series of holes of varying diameters. The iris diaphragm is another excellent contrivance, consisting of a series of overlapping metal plates placed inside the lens tube and fastened to a ring outside. By merely rotating the ring, any desired aperture can be secured. Until experience has been acquired, it will be better to confine oneself to $\frac{f}{10}$ for portraits and $\frac{f}{30}$ for landscape, etc., and to use no others.

23.—**Comparison of Stops.**—There are few things in photography about which more ignorance prevails than in the comparative exposures required with different stops. And yet the thing is simplicity itself. First of all it is absolutely essential to ascertain the correct value of each aperture in terms of the focal length of the lens. How to find this we have already explained. Let us suppose the stops to have been measured and marked accordingly—say there are three, $\frac{f}{10}$, $\frac{f}{20}$, $\frac{f}{30}$. Now square each of these numbers, and we get 100, 400, and 900. Reduce these to the simplest ratio, and we have 1, 4, 9. Then whatever exposure we give with $\frac{f}{10}$ we must give *four* times as much with $\frac{f}{20}$, and *nine* times as much with $\frac{f}{30}$. Or, *vice versâ*, if we know that it requires thirty-six seconds to secure a satisfactory negative of a certain subject with the stop $\frac{f}{30}$, then we must only give four seconds if we use $\frac{f}{10}$.

24.—**Sensitive Plates.**—The gelatine dry plates sold commercially at the present day are—almost without exception—good and cheap. Let the worker undo his parcel of plates (each parcel or box should contain one dozen plates) in his dark room. Inside will be found a paper of instructions. Take this paper and also *one* of the plates, and bring them out into the light of day. "But the plate will be spoiled if exposed to white light!" you exclaim. Yes, my friend, and you must expect to spoil many a dry plate in learning photography. But never mind that, so long as each spoilt plate teaches you something.

Notice how brilliantly the light is reflected from the clear glass back of the plate, while the working side is dull, and has a "matt" appearance. The film, or coating of gelatine, which it bears is extremely thin when dry; its creamy appearance is due to the presence, embedded in it, of countless molecules of silver bromide, a compound of which Stas—the great Belgian chemist—said, as long ago as 1874, that it was "the most sensitive substance to light with which I am acquainted."

There is usually a little of the emulsion of gelatino-bromide of silver upon the back of the plate also, but this is of no importance. Examine the film carefully to see that

it is of a good and even thickness, and free from spots. Try another dry plate in the dark room, holding it between your eye and the flame inside your ruby lamp; the outline of the flame ought not to be visible through the plate; if it is, the plate is too thinly coated.

25.—**Choice of a Dry Plate.**—Gelatine dry plates are advertised of two or even three degrees of rapidity; and they are commonly labelled "Slow" or landscape plates, "Rapid" plates, and "Instantaneous" plates. Sometimes these are classed as twenty times, thirty times, and sixty times respectively, meaning that they are twenty, thirty and sixty times more sensitive to light than an average wet collodion plate, such as was formerly in use. A much better distinction is to quote the number of degrees of rapidity as registered by an instrument called Warnerke's sensitometer, whose range is from one to twenty-five. On this instrument the slow plates register from 12 to 15, the rapid plates from 18 to 21, and the instantaneous plates from 22 to 25.

By all means commence photography with a slow, thickly-coated plate. Even after you have tried the others you will come back to this class for general out-of-door work. Of course, for moving objects, street scenes, &c., the most rapid plates must be employed. But, unless you wish to court failure, let all such subjects religiously alone until you have been at work at least a year, and can take a good picture with certainty on a slow plate. An instantaneous plate is spoiled—fogged—by the most transient exposure to even weak or diffused white light, and unless it has had the correct, or very nearly the correct, exposure in the camera (and for such plates the limits of correct exposure are very narrow and extremely brief), it will not give a satisfactory picture. Keep each kind of plate to its proper work, and above all try to learn to walk properly before you attempt a headlong run.

26.—**Stand or Support for Camera.**—Some sort of support for the camera is indispensable. We may carry a *clip*, by which the camera can be affixed to a rail, post, etc.; but then it is very improbable that rails and posts will be found just where they are wanted, so that,

except for work on board ship, or perhaps on the top of an omnibus, the clip is not all that could be desired. By general consent a three-legged stand or tripod forms the most convenient camera-stand. It should be made of light wood—pine or ash—and each leg should be in two parts. In the best form of tripod the lower half of each leg slides within the upper half; but those which fold also answer

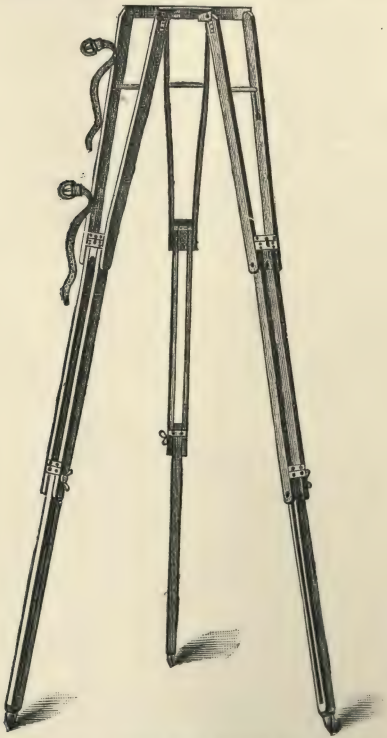

Fig. 7.—Tripod stand with sliding legs, and straps.

well. The tripod top is usually triangular in shape, and the camera is fastened upon the "legs" by a screw passing

through the centre of the top. This screw should form a part of the top and not be removable from it. There are few things more aggravating on an excursion than to find that "the tripod screw has been left behind!"

There are several telescopic tripods, the legs being made of metal tubes which slide one within the other. Such tripods can be carried in a bag, but they are usually heavier, more easily damaged, and not so generally satisfactory as the wooden ones. Above all things, a tripod should be rigid and firm, for the least shake of the camera during the exposure will produce a blurred picture.

27.—**The Focussing Cloth.**—With light falling upon it from behind, as well as from the lens in front, the image on the ground glass is almost invisible. But when this back light is shut out by throwing an opaque cloth over the head and camera—keeping the eyes a few inches from the ground glass—then the picture becomes visible. Most photographers use a focussing cloth made of black velvet or velveteen, and about three feet square. Thin mackintosh, however, is much better, and it is best to have it a good size—say three and a-half feet square—so that it may completely wrap over and protect the camera from wet, etc. A good plan is to sew an indiarubber ring in the middle of one side; this ring can then be slipped over the lens tube, and helps to keep the cloth in its place. A small piece of lead should be sewn into each corner of the cloth to keep it down when it is windy. The danger of stray light affecting the sensitive plate during its exposure, or by finding its way through some crevice or pin-hole in the dark slide, may be lessened by always keeping the focussing cloth wrapped round camera and slide while the plate is being exposed. By sewing two or three buttons along one side of the cloth, and a corresponding number of loops on the opposite side, it is easy to secure the cloth firmly over the camera, thus preventing the cloth from flapping about during the exposure, and also excluding dust when the camera is carried upon its tripod along the roads.

CHAPTER III.

Photographic Apparatus for the Production of Negatives : (b) Accessories.

28.—**Accessory or Additional Apparatus for Negative Making.**—The twelve articles of apparatus to be next named and described will be found very useful to the photographer, but they are not absolutely indispensable :—

Travelling Case.
Focussing Glass.
Spirit Level.
Photometers.
Exposure Tables.
View Meter.
Changing Box or Bag.
Shutters.
Finder.
Note Book and Pencil.
Map.
Compass.

29.—**Travelling Case.**—A waterproof case to hold camera, dark slides, etc., is an all but necessary adjunct.

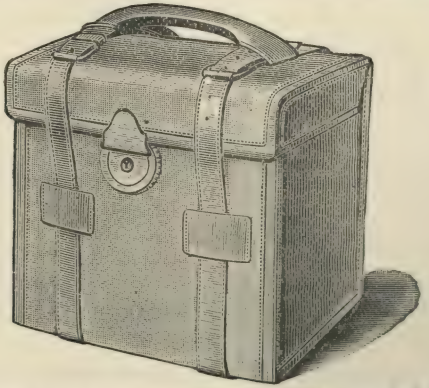

Fig. 8.—Travelling case of enamelled leather, to carry camera, dark-slides, etc.

It should be light and strong, and provided with leather straps by which it can be carried in the hand or on the back. For sizes above whole-plate it is best to carry one's things in two cases, as one then balances the other; unless, indeed, the knapsack form for the back be preferred. The case should be divided into compartments so that the dark slides may be separated from the camera. Enamelled leather is the best material for cases, but it is rather heavy. We have found cardboard covered with good canvas to answer very well. It is a good plan to have a well-fitting cover made of some thin waterproof material for each dark slide; the cover should button over at one end. This helps to exclude dust, and also protects the slide from light during its passage from the travelling case to the camera.

30.—**Focussing Glass.**—To obtain the sharpest possible focus on the ground glass, some form of magnifier is necessary. A watchmaker's eyeglass answers well. It is most useful when copying, or in focussing interiors.

31.—**Spirit Level.**—When the camera is set up in front of any object it ought to be placed horizontally. To ascertain this by the eye alone is not easy, especially on sloping ground. It is a good plan, therefore, to carry a small spirit level, which can be applied first across and then along the camera, so that it may be placed level in each direction. Still better would it be to have a T-shaped or a circular spirit-level inserted in the woodwork of the camera.

32.—**Photometers.**—These are instruments intended to register the actinic or chemical power of the light at any moment. The varying power of daylight is one of the greatest practical difficulties with which English photographers have to deal, and if any quick, cheap, simple, accurate, and easily-read photometer could be devised it would be a great boon. Perhaps the simplest photometer is a small piece of sensitised paper, which is exposed to the light, and the time taken for it to darken to a given tint noted. However, "experience is the best photometer," and we must all buy our experience through the medium of a number of incorrectly-exposed plates.

33.—**Exposure Tables.**—Although experience is the best guide to the right time for which a plate ought to be exposed in the camera so as to produce as perfect a picture as possible (many workers study the appearance of the image as seen upon the ground glass, and go by that entirely), yet *some guide can be found* in the experience of others printed in a tabular form. Such exposure tables tell us the average intensity of the light for each hour of the day and for each month of the year. Then we must know the rapidity of our plates, the ratio of the diameter of the stop we are using to the focal length of our lens, the kind of subject which is before our lens, and we must also judge the state of the sky—whether clear, cloudy, dull, etc.

Knowing these six things, the exposure table—six or eight are issued by as many different authors—will tell us the exposure we ought to give, and it will generally be found pretty correct.

34.—**View Meter.**—It is an important thing to know exactly the best spot from which to photograph any particular object. You set up your camera—no, too near—you walk round to the other side—now too far off. Most of the trouble of repeatedly moving the camera can be saved by the use of a view meter, which is a little contrivance intended to show exactly how much of any object or scene will be visible upon the ground glass with a given lens. There are many forms of view meters, but that which resembles a single opera-glass reversed is the one we prefer. As the instrument has a sliding tube it can be adjusted so as to give the exact field of view for several lenses, and by having a removable front, it can also be adapted to any size of plate.

35.—**Changing Bag.**—The three double dark slides with which a camera is usually provided afford the means of taking six photographs. This number may, and probably will, be found enough for a half-day excursion, but with so limited a number there is always a fear of "expending one's ammunition," and good pictures are lost because there may be something better further on, and we "must save a plate for that, you know." If we carry a spare dozen or half-dozen plates, we *may* find a dark room in which to change, or we *may* discover a gloomy cellar, the window of which

can be blocked up, and the plates changed by the "feel," or by the help of a pocket ruby lamp.

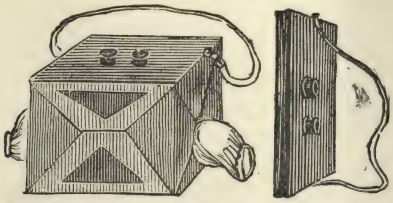

Fig. 9.—Changing box or bag (Shew's), shown open and closed. It is provided with sleeves through which the arms can be inserted, and eye-pieces glazed with ruby glass; also a strap to carry it by.

But a good changing bag makes the photographer independent of all these. It can be purchased, or a large bag with arm-holes can be made by sewing together two or three thicknesses of black and yellow twill, the seams being turned in or braided so that light cannot penetrate. The arm-pieces should have a stout piece of elastic round them. In changing plates within such a bag by the "feel," it is useful to previously gum a small piece of white paper (postage-stamp edging) on one corner of the plain glass side of each plate. A changing bag of good size, made as described above, will also answer as a focussing cloth.

36.—**Shutters**.—There are many objections to the ordinary lens cap. It is easily lost or mislaid; unless deep and well-fitting it admits light round its circumference (this can be detected by taking the camera—lens capped—into sunlight, turning up the ground glass, and putting the head beneath the focusing cloth, when a faint ring of light may in such a case be seen round the lens, enough to spoil the brilliancy of any picture, and probably to fog the plate). In taking off the cap it is possible to cause the camera to vibrate; moreover, some light is reflected into the camera from the interior of the cap each time it is removed and replaced. But the chief objection to a cap is that it is impossible to give a shorter exposure by its aid than about one-quarter of a second. For quick exposures a contrivance called a *shutter* is absolutely necessary. Some hundreds of shutters have been patented; and by obtaining catalogues

from the dealers their forms and peculiarities will be studied. Place's shutter is a form which we have found to answer admirably instead of a lens-cap. A good shutter should give an exposure as short as the sixtieth part of a second, but this exposure should be capable of *variation*, for the tenth of a second is sufficient for most moving objects, provided they are not too close to the camera. The best shutters are worked by the pneumatic action of air contained in an indiarubber ball and tube. For portraiture the best form of shutter is that which is inside the camera, and which is opened by the compression of the hollow rubber ball by the hand, and which closes when the pressure is removed.

37.—**Finder.**—It is always an advantage—and in instantaneous photography especially—to know exactly what will be on the surface of the plate at the moment of exposure. For this purpose a "finder" may be fitted to the top or side of the camera. Sometimes the finder is simply a miniature camera, sometimes a concave lens, sometimes a wire framework fitted on the camera-front with an eye-hole at the back. The best finder is a second camera precisely similar to the first, and placed on top of it. But this would be very cumbrous and heavy, so that the alternative has generally been adopted of turning up the ground glass until it is vertical, fitting a lens of suitable focus on the front of the camera, and connecting lens and ground glass by light wires or rods, over which is thrown the focussing cloth. With the head under the cloth it is then possible to expose when the moving object is exactly in the desired position, for its image will occupy the same relative place both on the ground glass above and on the dry plate below.

38.—**Note-book and Pencil.**—The particulars of each and every exposure should be jotted down *at the time*. Such a record is invaluable for future use. The name of the place, nature of the light, lens used, stop, exposure given, etc., should all be entered. For one thing, this is a pretty sure preventive to exposing the same plate twice, and it is also useful when the plates come to be developed, and as a guide in the future. Several note-

books, specially prepared for such entries, are now to be obtained.

39.—**Map and Compass.**—The maps of the Ordnance Survey, on the scale of one mile to an inch, are rather expensive (one shilling per quarter-sheet), but they are by far the best, and are very useful. A compass is also of great service, not only in uninhabited districts, like many parts of Wales and Scotland, but in giving the true direction of a building, and hence the time when it will be most suitably placed with respect to the sun to "have its photo taken."

40.—**List of Apparatus.**—Keep a list of all the articles required for out-of-door work pasted or pinned inside the lid of your camera-case. Every time you pack up, tick off the articles on this list as you put them in their places. The amount of bad language uttered annually by photographers who find themselves in front of some "lovely view," but minus some necessary piece of apparatus, and far from home, would be perceptibly less if this plan were universally adopted.

CHAPTER IV.

Development of Negatives: Materials Required.

41.—**The Dark Room.**—It has been known for about a century that red light has little effect upon the sensitive salts of silver ordinarily employed in photography. Indeed, if we could use no light at all in the manipulation of our dry plates, photography would be all but impossible, since we should have to conduct all our operations in the dark. The dark room—which ought really to be called the "red room"—may be any small room at the disposal of the worker. It should not be too small, however, as it is a great mistake and detrimental to the health to use a stuffy little cupboard. All crevices through which white light could enter must be carefully covered over with brown paper or a curtain or two. The chief difficulty will be the window. This may be covered with a large double curtain made of ruby and of yellow fabric; or a light wooden frame covered in the same way may be made to fit the window. But if it looks to the south, even this protection will not be safe against the full glare of the sun. In such a case it is better to have a curtain or framework made of quite opaque material, so as to block out the daylight altogether, and to use artificial light only. Many workers make it a principle to develop only at night, as they then feel safe from extraneous light. To test if the dark room is perfectly light-tight, the door and window should be closed, and all lights put out, while the worker sits in the room with his eyes closed for four or five minutes. In this way the sensitiveness of the eyes to stray light will be increased, and the crevices which admit it can be detected more readily. It is the direct rays of sunlight which are to be specially feared; a dim reflected

light, especially from gas or candles, can be dodged on occasion—as when travelling—by turning one's back to it. But absolute safety is only to be found in the exclusion of all light, except red or yellow, and in exposing one's plates as little as possible even to that.

It will be a great advantage if the dark-room has a water-tap over a sink, near which the developing table can stand; it ought also to be fitted with some shelves, for dishes, etc., and a cup-board in which chemicals and apparatus can be stored. Instead of a sink we may use one or two buckets of clean water, and an empty bucket into which to throw the slops.

42.—**Apparatus for Development.**—In photography it is possible to "make shift" with many things. Thus, shallow pie-dishes can be used for developing-dishes, and a large white egg-cup makes a good developing measure for quarter-plates. But in the long run it will be found better and cheaper to procure apparatus specially fitted for the work.

43.—**The Lamp.**—A good lamp, glazed with ruby glass and burning paraffin oil, gives the most generally useful light. A sheet of ground glass, sliding in a groove in front of the ruby glass, makes the light more diffused and more pleasant. Yellow light is preferred by some, but the sensitive plate must be kept at a greater distance from it. Raise the lamp about six inches above the table by placing it on a block of wood.

Workers who have gas laid on to their dark-rooms will find a chimney of ruby glass fitting on a gas-burner very useful, and a ground-glass globe outside it pleasantly diffuses the light. Gas-burners are sold in which, by a bye-pass, a little jet of gas burns constantly in a recess, giving no light, but lighting the main burner when the tap is turned on, thus saving the necessity for striking a match. A tin cover or shade can easily be arranged to prevent the escape of white light from the top of any chimney or lamp, but in practice it will be found that the light after reflection from the ceiling is practically harmless. A piece of red or yellow paper pinned to the ceiling above the light will obviate any fears, however.

44.—**Developing Dishes.** — The size of these depends on the size of the plate employed, which ought to just lie comfortably on the bottom. The bottom should be ridged, as it is then much easier to lift the plate. We require at least (*a*) a glass dish to develop the plate in; (*b*) a vulcanite dish in which to fix it. Keep each dish to its own work, and label or mark it very plainly, so that each can be distinguished from any other.

The portable trays made of Willesden paper, by Tylar, are very useful to the tourist, as they lie perfectly flat.

45.—**Glass Measures.**— A four-ounce graduated lipped glass measure to contain the developing solution will be needed, and a minim measure to measure out small quantities of liquids.

46.—**Washing Dish.**—It is very useful to have a large well-glazed stoneware vessel, which will hold a gallon or so of water, in the developing-room. Things can be soaked or washed in it as desired.

47.—**Dish Covers.**—A cover for the developing-dish, made of cardboard or tin painted red, will be found useful. Or a square of ruby glass laid upon the top of the dish will answer the same purpose.

48.—**Camel-hair Brushes.**—Two flat camel-hair brushes about two inches wide, to dust the plates and remove air-bubbles from the gelatine film, should be purchased.

49.—**Chemicals Used in Development.**— There are many developing solutions, but we shall here only treat of the one which finds most favour with British photographers, *i.e.*, the "pyro-ammonia."

There are three ingredients in this developer, and they must be purchased and kept separately.

First we have pyrogallic acid, more properly called pyrogallol—a snow-white feathery substance, extremely light, and very soluble in water.

Next comes ammonia (the *liquor ammoniæ* of the druggist's shop), a colourless alkaline liquid having a very pungent smell. Ammonia proper is a gas, and the liquid which is sold as "ammonia" is in reality a solution of the gas in water. When left exposed to the air the ammonia

gas rapidly evaporates from the water. Ammonia is therefore known as the "volatile alkali."

And lastly we need some ammonium bromide, a white salt also soluble in water.

50.—**How to Make Up the Developing Solutions.**—Always prepare your chemicals for development in the form of ten per cent. solutions.

First take one ounce of the ammonium bromide, place it in a glass-stoppered bottle of convenient size, add to it ten ounces of distilled water, and shake vigorously until the solid is completely dissolved.

Next pour one ounce of ammonia into a similar bottle (it is important that this should have a truly-ground glass stopper), and add to it nine ounces of distilled water. The strong ammonia as purchased from the chemists should be of "s.g. ·880;" that is, its specific gravity should be less than nine-tenths that of water. It should be diluted with water as speedily as possible, for it does not keep well in the strong or pure state. It should never be kept in a corked bottle, as the ammonia vapour speedily corrodes the cork. It is a good plan to tie down the stopper of the ammonia bottle—especially when travelling, and in hot weather—as the pressure of the vapour within the bottle sometimes blows out the stopper if this precaution be disregarded. Keep the ammonia, and, indeed, all chemicals, in a cool, dark, dry place.

Now we have only the pyro left. A plain solution of pyro in water soon turns brown and loses its strength. To prevent this we must add some other chemicals to the solution. Dissolve four ounces of pure crystallised sulphite of soda in four or five ounces of hot (not boiling) distilled water; add to this fifteen grains of crystallised citric acid; pour the whole over one ounce of pyro, and make up the total quantity to ten ounces by adding distilled water. One great point in this formula is to ask for pure *sulphite* of soda, and *see that you get it.* The crystals ought to be transparent; it is a good plan to rinse them well in water before dissolving. *Sulphate* of soda is quite a different chemical, and will do harm instead of good in

the developing solution : by exposure to the air, long keeping, etc., sulphite passes, however, into sulphate, but this change can be detected by the white, powdery appearance of the surface of the crystals. Pyro so prepared ought to keep nearly colourless for months, or even years.

The "sulpho-pyrogallol" prepared by the Platinotype Co. is made up practically in the above manner. Marion's and many other firms also prepare similar ten per cent. solutions of preserved pyro, etc. Or any good chemist will prepare all or any of above-named solutions from the directions here given.

51.—**Mixing the Developer.**—The quantity of developer required will obviously depend on the size of the plate. It must be sufficient to cover the plate thoroughly well as it lies in the developing dish, say to the depth of a quarter of an inch. It is better to use a liberal quantity of developer, as air-bells and other evils will thereby be prevented. Distilled water should always be used for making up the developer, and the quantities may be two ounces for a quarter-plate, three ounces for a half-plate, and four ounces for a whole-plate.

Suppose we are about to develop a quarter-plate negative. We have our three bottles containing ten per cent. solutions of pyro, ammonia, and ammonium bromide before us, and also a measure containing two ounces of distilled water. We wish to use the following proportions :—Two grains of dry pyro, two minims of strong ammonia, and one grain of dry ammonium bromide to the ounce. As there are two ounces of developer, we must multiply these quantities by two ; and as the substances are in the state of ten per cent. solution, we must further multiply by ten. This gives us—

Pyro Solution	40 minims.
Ammonium Bromide Solution	20 ,,
Ammonia Solution	40 ,,
Distilled Water	2 ozs.

Add to the water first the pyro and then the ammonium bromide, measuring them out by means of the minim measure. Do not, however, add the whole of the ammonia at once. Commence with, say, five or ten minims of it, and add the rest by degrees as the plate seems to require it.

The table below shows the amount of each ingredient required for the different sizes of plates there named :—

	Of a ten per cent. solution.			
	WATER.	PYRO.	AMMONIUM BROMIDE.	AMMONIA.
	Ounces.	*Minims.*	*Minims.*	*Minims.*
¼-plate or 5 × 4 ..	2	40	20	40
½-plate	3	60	30	60
¼-plate	4	80	40	80

But these quantities are not "unchangeable as the laws of the Medes and Persians." If we know or suspect *under-exposure*, the quantity of ammonium bromide should be reduced to one-half, or over one-quarter ; while for *over-exposure* it may be doubled. The ammonia we add by instalments, so that we can stop when we please ; but if necessary to bring out the details, a little more—say one quarter—than the quantities given may be added. To exceed this last-named amount will be to risk fogging the plate. The photographer's motto should be, "Develop slowly, and do not add more ammonia until the action of that already at work in bringing out the picture seems to have fully stopped."

52.—**Functions of each Element of the Developer.**—What is the work which each of the three active ingredients of the developer is supposed to perform ?

The pyrogallic acid is the true developer, and by its aid alone a plate might be developed. But it would be a tedious task, requiring hours, or it might be days. Up to a certain point, increase of pyro means increase of *density*, but after the amount of pyro has been raised to three or four grains per ounce of developer, there is no practical use in adding more.

From this we see that spbjects which naturally possess strong contrasts—a whitewashed cottage for instance—should have a developer weak in pyro (say half-a-grain to

the ounce), while for "flat," evenly-lighted subjects, the amount may be increased to four grains per ounce.

The ammonium bromide exerts an influence upon those molecules of the silver bromide which have not been acted upon by light. It prevents these molecules being affected by the other ingredients of the developer. Hence we say the ammonium bromide *acts as a restrainer*, preventing fog and keeping the shadows clear.

Lastly, the ammonia stimulates the pyro to constant and increased activity. It brings out the detail, and may be styled the *accelerator*.

It is of the utmost importance that the special power and work of each chemical in the developer be clearly understood. This, indeed, is the foundation of a scientific knowledge of the art of development.

53.—**Distilled Water.**—The water used in photographic operations is not without influence upon the results. For making up the developing and the toning solutions "distilled" water should be employed. This is obtained by boiling water in a vessel called a still, and then cooling the steam so produced, by which it is "condensed" into water once more. In this way pure fresh water can be obtained even from muddy salt water. Such distilled water can easily be made at home—a good still can be bought for about 18s.—or it can be purchased from a chemist's at a price of sixpence per gallon.

In the country, where the rain falls through pure air and runs off clean roofs, it may be nearly equal to distilled water. Most tap and well waters are more or less *hard*, this hardness being generally due to the presence of carbonate of lime in solution. By boiling the water the greater part of this substance can be got rid of. Water containing iron—chalybeate water—is unfit to be used for any photographic operations.

54.—**Alum Solution for Hardening.**—During development the film of gelatine becomes soft and tender. Sometimes it "frills" or blisters, that is, crumples up and leaves the glass, especially near the edges. It is then a good plan to rinse the plate carefully in water and allow it to soak in a solution of alum for five minutes.

The alum should be bought ready powdered, and dissolved in hot water until the water is saturated. The saturated solution may then be poured into a large bottle and labelled "Saturated solution of alum." As it cools crystals of alum will be deposited on the bottom of the bottle, but these can be used up by adding more water and shaking when required. For use for hardening, this saturated alum solution should be diluted with about half its bulk of water. It may be used over and over again until it becomes much discoloured.

55.—**Hyposulphite of Soda for Fixing.**—The chemical familiarly called "hypo" is at the same time the photographer's friend and his bane. It is most useful to him in fixing or clearing his developed plates, but it will injure any other chemical, or dish, or picture, etc., with which it may come in contact. As hypo is very cheap, a good quantity should be bought at a time—say 7lbs.—and it should be kept in a brown stone jar with cover. It should be prepared for use in the form of a twenty per cent. solution, *i.e.*, every twenty ounces (one pint) of the solution must contain four ounces of hypo. A good plan is to put a quart of water in an enamelled iron sancepan, add eight ounces of hypo, and heat gently (stirring well) till the hypo is dissolved. Then bottle off in ordinary wine bottles, or in the large glass bottles called "Winchester quarts." Add to each quart of hypo solution a couple of drams of ammonia. Paste brown paper round the bottles to exclude the light, and label them carefully. Take special care that no hypo is dropped or spilt in your dark room.

56.—**Clearing Solution.**—After fixing and well washing, the gelatine film often presents a discoloured and yellow appearance. This can generally be removed by soaking the plate for a few minutes in the following solution:—

Saturated Solution of Alum	
Water	2 ozs.
Hydrochloric Acid	1 oz.
Ferrous Sulphate	1 dram
	50 grs.

Citric acid can be used instead of hydrochloric, and the ferrous sulphate (green vitriol) can be omitted if desired.

The plate must not be left in this solution long, but must be examined every half minute. As soon as the stains are removed the plate must be well washed for at least ten minutes in running water. It may be said that *all* negatives will be improved by the use of this clearing bath. It must be remembered, however, that it is also a *reducing* bath, *i.e.*, it will reduce or diminish the intensity of the image if the plate is left in it too long.

57.—**Filtering.**—All the solutions used in photography ought to be filtered to remove stray particles and solid matters ; they will then look clear and bright. Circular filter papers can be purchased in packets of 100 for a few pence, and a couple of ribbed glass funnels of two and four inches diameter should be procured to use with them. Each filter paper is folded, first into a semicircle, and then again so as to make a quarter circle. One quarter of the circle is then opened out, so that the filter paper forms a cone which fits inside the funnel. The liquid to be filtered should be poured against the thick side of the filter paper; and a strip of paper or a match should be placed between the neck of the bottle into which the liquid is being filtered and the neck of the funnel, so as to allow the air free exit.

CHAPTER V.

How to Develop Negatives.

58.—**The Latent Image.**—When an exposed plate is removed from the dark-slide, its creamy-white or buff surface shows no signs whatever of a picture. Yet the picture is there; but it is so feeble as to be invisible to our eyes. In this state it is called the "latent" or "photographic" image. To strengthen this weak image is the task of the developer. This it does by enabling the molecules of silver of which the latent image is composed, and which lie on the top of the film, to lay hold of the silver in the molecules of silver bromide beneath them. In an ordinary plate this process should be allowed to continue until in the "high lights" the silver has been reduced to the black metallic state right down to the surface of the glass, so that it is visible as a black stain when the plate is turned over and the back examined; in fact, with most plates, development should be continued until all the leading outlines of the picture can be seen on the back of the glass plate. With thickly-coated plates, however, development must not be carried so far, or the resulting picture will be too dense and intense. Experience will soon teach us how best to manage the brand of plates we are using.

59.—**Developing the Plate.**—Perhaps the most pleasurable moment in photography is when the worker sits down (always *sit*) before the dark room table ready—with fair expectations of good results—to commence the development of, say, half-a-dozen plates. The dishes and chemicals are arranged in due order on the table, the ruby lamp is lit, all white light is excluded, and the first plate is extracted from the dark slide.

Passing a broad, flat camel-hair brush lightly over the dull coated side of the plate, we lay it, film upwards, in the

developing dish. Then with a turn of the wrist we pour the developing solution so that it flows in a wave over the plate. Taking up a second brush, reserved for this purpose only, we pass it over the plate as it lies in the solution. This is to remove any air-bells, which often cling obstinately to the film. Now we cover the dish with our cardboard, glass or metal screen, and rock it vigorously first one way and then the other.

60.—**Appearance of the Image.**—The developing dish should be kept about one foot distant from the ruby lamp. Its surface should be examined every half-minute by removing the cover and giving a hasty glance. Starting with the weak developer already described (paragraph 51), it may be necessary to make two or three additions of the alkali before any change is seen on the surface of the plate. At last, however, a slight darkening becomes apparent. If it is a landscape this dark part will represent the sky; if a portrait, the white collar, hands and face. In every case the *high lights*, or brightest parts of the original object, will appear first, and will be black in the negative. Soon some other parts of the plate begin to turn grey; these are the "half-tones," representing such portions of the original as were neither very dark nor very light. Still other parts of the plate remain white; these represent the "shadows," or darkest parts of the object photographed—as, for example, foliage in landscapes, a black coat in a portrait, etc. By the addition of still more ammonia we shall cause finally even these parts to turn grey, providing the negative has not been much under-exposed, and so we shall secure the highly prized "detail in the shadows."

61.—**When to Stop Development.**—Two principles underlie the whole of one's work with the negative—correct exposure and proper development. But of the two the latter is the more important. Over-exposure can be compensated for to a considerable extent, and under-exposure to a small extent, by a master of the art of development.

Broadly speaking, let us keep two things in mind in developing—(1) Develop slowly; (2) do not stop development too early.

When development seems nearly complete, examine carefully the *back* of the plate; the main lines of the image should there be distinctly visible, that is, with "Ordinary" or "Rapid" plates. With the thickly-coated slow plates which are now, we are glad to say, being introduced, the image may be scarcely visible at the back, or not at all when development is complete. On the surface of the plate everything should be black or grey, at least no large patches of white should remain.

Hold up the plate, film side towards you, between your eye and the ruby lamp, and quite close to the latter. The "high lights" should be quite opaque, and the whole picture should appear strong and well marked. All this may take some ten or fifteen minutes, during which the plate should be exposed as little as possible, for even the red light will have *some* effect on it. Finally, rinse the plate well in water, and pass a pad of cotton wool lightly over the film while it is under the tap or in the water. If the plate belongs to a make which is given to frilling, let it now soak for five or ten minutes in the alum solution to harden it. Then wash well again in water, and transfer it to the hypo bath to fix.

Special care should be taken to allow no trace of the hypo solution to get into the developing solution, the result of which would be to destroy its developing power, or to make its action irregular. For this reason the two dishes should be kept as far apart as possible, that no hypo may be splashed or dropped into the developer. If the fingers are immersed in hypo, the hands should be washed with soap and water before touching a fresh plate, and the nail-brush should be used to remove the hypo which will lurk under the finger-nails.

It is important, too, never to drop crystals of hypo, or hypo solution, about the dark-room. The crystals get trodden to powder; and the water of the solution evaporates and leaves behind it the hypo in the form of minute crystals. This "hypo-dust" gets blown about the room, and may be carried by air-currents into the various dishes, solutions, etc. Absolute cleanliness is in photography one of the safeguards of success.

62.—**Dodges in Development.**—If the picture appears at almost the same time all over the plate, high lights and detail in shadows appearing together, it is a sign that the plate is much over-exposed. In such a case the best thing is to *instantly* rinse the plate in water, and apply a developer containing treble the original quantity of ammonium bromide, or the plate may even be soaked in bromide solution alone, and then the restrained developer (which should be very weak in alkali) applied.

On the other hand, although the exposure may be right, or full, for the greater part of the picture, yet there may be parts, such as dark foliage, etc., which are under-exposed. Pour off the developer, and breathe repeatedly on those spots which remain obstinately white, holding the plate almost touching the mouth, or breathing through a cardboard, or paper tube; then pour the developer in a thin stream so as to fall on the same spot. Also take a small brush and dip it in a little ammonia solution (say one part of the ten per cent. solution to two of water) and paint this over the required parts, then pour the developer on. On the other hand, if the high lights appear quickly and increase very rapidly in density, so that there is a danger of their becoming too opaque, they may be painted over (the plate being removed from the developing dish and held in the left hand) with the solution of ammonium bromide, which will check further increase of density in those parts. Repeat these processes again and again.

Another plan or remedy for over-exposure is to allow the image to just fully appear, and then to plunge the plate into a weak solution (1 to 100) of citrate of ammonia; wash this off after a minute or two, and apply the developing solution again. The ammonia citrate is made by *nearly* neutralising a solution of citric acid with ammonia. By tilting the dish, too, the developer can be kept mainly on those portions of the plate which most require it.

There is a danger, however, in the use of all these "dodges" of doing more harm than good, and it is only after a certain amount of skill in development has been attained that they can be usefully brought into practice.

63. — **Fixing the Negative.** — Except in hot weather, and with a brand of plates which we know to be liable to frilling or blistering, the use of the alum bath (par. 54) after development is hardly necessary. The developed plate should be thoroughly rinsed in water and placed in the fixing bath (par. 55). The film side must, of course, always be kept upwards, and there should be enough hypo to cover it to the depth of half an inch. The fixing dish should occasionally be rocked. The action of the hypo is to dissolve out of the film all the silver bromide which has not been acted upon by light. After ten minutes the plate may be lifted out and the back examined. If no trace of the white silver bromide can be seen the plate is probably "fixed"; but it is better to allow it to remain in the bath another five or ten minutes, or, better still, to place it in a *second* bath of hypo for that time. The same solution of hypo can be used over and over again for fixing *plates* until it becomes quite dark in hue; but hypo is cheap, and it is not worth while to run the risk of staining the negative or imperfectly clearing it, so that it is as well to change the hypo solution when from half-a-dozen to a dozen plates have been fixed in it.

64.—**Washing the Negative.**—When the glass plate is removed from the fixing bath it should be well rinsed under the tap, or in fresh water, and then left to *wash* for several hours. The object of this long-continued washing is to remove every trace of hypo from the film. If any of this deleterious salt remains, the negative will soon fade and become yellow and spotty. The best form of washing trough is perhaps that in which the plates stand vertically in grooves while a syphon removes the water from the bottom. If the plate can be allowed to drain at intervals, so much the better. It is usual to allow the negatives to wash all night; but by completely changing the washing water every ten minutes, and occasionally rinsing the plate under the tap, it can be washed, if need be, in three hours.

When the washing is completed, the surface of the film should be gently rubbed, under water, with a pad of clean cotton wool. The *back* of the plate should be cleaned by

rubbing it well with a little common salt. After a final rinse, the back of the plate can be dried with a cloth, and the finished negative placed leaning against the wall (film side in) and standing on a piece of red blotting-paper until it is dry. Drying may be accomplished in an hour or two, or it may take a day, according to the state of the atmosphere.

Never attempt to dry gelatine plates very quickly by holding them near the fire; the heat will melt the gelatine. It is a good plan, however, to stand the plates on the chimney-piece of a room in which there is a moderately good fire, or even on the floor, leaning against the wainscot four or five feet from the hearth.

If it is desired to dry a negative very quickly, the back should be rubbed with a towel, and the film carefully dabbed with a clean linen towel, or with a piece of blotting-paper which has been brushed in order to remove any loose fibres or bits of fluff. The negative should then be laid, film upward, in a dish of methylated spirit, and allowed to remain there for five minutes. The spirit rapidly extracts the water from the film, and on removal from the bath the negative will dry in about ten minutes.

CHAPTER VI.

Preparation of the Negative for Printing: Retouching, etc.

65.—**Defects in the Negative: Fog.**—The negative when dry should be carefully studied both by reflected and by transmitted light. If the surface is grey all over, even the shadows being "veiled," the plate is said to suffer from "general" or grey fog. This foggy appearance may be caused (*a*) by stray light in the camera, (*b*) by the light used in the dark room, (*c*) by considerable over-exposure, or (*d*) by the use of an undue quantity of alkali during development. We have shown in paragraph 36 how defects in the camera can be detected. To test your dark-room light, put a plate in a slide, draw the shutter out half-way, and leave the plate in the usual position of your developing dish (the ruby lamp being lighted—in fact, everything as usual) for three minutes. Now put out the light and develop the plate for five minutes in darkness (which is easily done by feeling). When fixed there ought (if the light is safe) to be no difference between the exposed and the unexposed halves of the plate.

Dark streaks running from the edges across the plate—often from one corner—indicate that the dark slide is defective in some way, either not being light-tight itself, or not fitting closely to the camera.

Dark slides (and the inside woodwork of the camera also) ought to be thoroughly well blacked inside. The wood, for the sake of lightness, is often cut so thin that the light passes right through it unless the pores are filled up with some black material.

66.—**Green Fog.**—Sometimes the negative looks coloured by reflected light—green or yellow—and (in very bad cases) the shadows (the clearest, most transparent parts of the plate) have a red tinge when seen by trans-

mitted light. This is called *green fog*. Some brands of plates give this kind of fog very readily, but with good plates it is only the result of forcing in development by the use of an undue quantity of ammonia.

All kinds of fog can be mitigated by the use of the clearing solution. Another good plan is (after the fogged plates have once dried) to rub the surface with a little methylated spirit applied on chamois leather.

Plates that have been "kept in stock" a long time—perhaps on the top shelf of a dealer's shop, exposed to all the emanations from the gas—will often show a dark or metallic band round the edges. Some plates are packed by inserting strips of cardboard between the films; these will sometimes leave a dark mark on each end of the plate.

67.—**Intensifying the Negative.**—Pictures that have been "over-exposed" are usually so thin (though full of detail) that they yield a flat print, which may be of a grey tint all over, because the light can everywhere penetrate through the deposit of silver of which the image is composed. In such cases the remedy is *intensification*. For this purpose make up the following solutions:—

A.	Ammonium Chloride (sal-ammoniac) ..	½oz.
	Bichloride of Mercury (corrosive sublimate) ..	½oz.
	Distilled Water	10 oz.

Dissolve the sal-ammoniac in the water, and then add the powdered bichloride of mercury. The use of the sal-ammoniac is to enable the water to dissolve the mercurial salt more readily. Shake well, allow to stand, and filter. The mercurial salt is a deadly poison, be it remembered. The negative must be soaked in this solution until it is of a greyish-white right through, as seen by looking at the back.

Now wash the plate thoroughly for, say, half-an-hour in running water, and then immerse it for five minutes in—

B.	Water	10 oz.
	Ammonia	2 drams.

In this the negative will blacken. If it was originally very weak—a mere ghost of a negative—use double the quantity of ammonia.

Finally, wash well for ten minutes in running water.

This process of intensification requires conducting with a little judgment, or the fine detail of the picture may be clogged up. Its great defect is that negatives so treated sometimes turn yellow or fade afterwards. Where this has occurred, however, it is believed to be because the washing of the whitened negative after treatment with the mercury has not been sufficiently thorough.

68.—**Reducing the Negative.**—Sometimes development has been carried too far, and the plate has become nearly opaque all over. In such a condition it may require days, even in strong sunlight, to get a print from it. In such a case the proper remedy is *reduction*. To effect this, soak the dried negative in a bath of hyposulphite of soda (one ounce to a pint of water) for about ten minutes. Remove the negative, and add to the hypo five or six drops of a solution of ferricyanide of potassium (*red* prussiate of potash) of the strength also of one ounce to a pint of water. Immerse the negative in the mixture, rock the dish, and remove the plate frequently to watch the process of reduction. When the desired effect has been obtained, wash well for an hour or two, and dry as before.

Sometimes it is desirable to reduce parts only of the negative. Perhaps one half of the negative is just of the right density, while the other half is so dense that the light can scarcely pass through it. In this case we must try to "dodge" the reducing so that only the dense half shall be materially affected. This may be done by soaking the negative well in the hypo bath, and then carefully *painting* the too dense portion with the red prussiate solution applied by means of a brush. Another plan is to coat those parts of the negative which we wish *not* to reduce with machine oil, applied very carefully by means of a fine brush; the entire negative can then be immersed in the reducing solution, which cannot act upon the parts coated with oil.

But let those who "take their negatives up and down," who spend hours, or it may be days, in "cobbling" them, and trying all the "dodges" which the ingenuity of photographers has been able to devise during the past half-century, remember that the easiest and the cheapest

plan is, after all, to take another negative. Where this is impossible—and it must be admitted that it often is so, because of distance, time, etc.—then no pains in mending or improving can be considered as wasted. If, however, you do not succeed, and only make matters worse instead of better—which is very probable—rather assign the want of success to your own want of practice, or skill, or to the absolute and irremediable badness of the negative you have started with, than to any defect in the methods here recommended, all of which have been proved successful by practised hands.

69.—**Varnishing the Negative.**—If it is desired to take only one or two prints from a negative it is not necessary to varnish it. In any case it is better to take *one* print from the negative before this operation is performed, as if it be necessary either to reduce or to intensify the plate (and this can be better judged from the print than from the negative) there must be no varnish on the film. It is true that the varnish can be readily removed by soaking the plate in methylated spirit and gently rubbing it with a piece of chamois leather, but it is better to save this trouble if possible.

The photographic varnishes sold by the dealers, under various names, have for their basis shellac dissolved in spirits of wine. They should be perfectly clear, and of a pale yellow or reddish-brown tint. Brush the film to remove any particles of dust, and then warm the back of the plate at a clear fire or over a gas-stove; the glass should feel warm but not hot to the hand. Hold the plate by one corner, and pour on the varnish in a pool in the centre of the plate; incline the plate so as to cause the varnish to run first to one top corner, then to the other, then to a bottom corner, and finally to be poured off from the fourth corner into a clean empty bottle. Rock the plate all the time that you are pouring off the varnish, and finally wipe the lower edge of the plate with a clean rag to prevent any lines or streaks. When this second bottle gets full the varnish should be filtered back through cotton wool into the first bottle; in this way it will always be used bright and clear.

After the varnish has been poured off, and the plate well drained, the back should again be heated, but this time more strongly, and until it is too hot for the hand to bear. This will "set" the varnish, and it will then form a hard transparent coating over the film.

If many prints are taken from an unvarnished negative—more especially if the film and the sensitised paper are at all damp—it will become covered with spots, which it is all but impossible to remove.

It is the practice of many photographers to give each negative a coating of plain or enamel collodion before varnishing it. The collodion is applied in the same way as the varnish, but it must be allowed to dry spontaneously—without heat.

Where a proper "photographic varnish" cannot be obtained, a good substitute for it can be made by diluting the best "brown, hard varnish" of commerce with an equal quantity of methylated spirit.

70.—**Spotting the Negative.**—When the plate is held up to the light, numerous holes are often found to exist in the film. Most of these are mere pin-holes, but others may be of larger size, while there may be also some tears or scratches. All these bare places will print black, and must, therefore, be filled up and allowed to show as little as possible. This is best done by mixing up a little Prussian blue rather thickly with gum-water, and applying it to the negative with a red sable brush well charged with the colour. The pin-holes are perhaps best "left alone;" but remember to prevent them by rubbing well into the inside of your dark slides a *little* dilute glycerine. This will catch the dust, which would otherwise settle on the plate.

71.—**Retouching.**—The gelatine plate exaggerates the shadows; moreover, yellow or red spots on the face, freckles, etc., are shown as grey or black, and are, therefore, much more conspicuous than in nature. To remedy all this, *retouching* has been introduced, which consists in adding, by means of light touches with a finely-pointed blacklead pencil, to the density of those parts requiring it, thereby causing them to print light, or even quite white if necessary. The retoucher usually varnishes his negative

first. He then rubs over the part to be retouched, say the face, with a little of the "retouching medium" sold at the shops (gum dammar 15 grains, rectified turpentine one ounce, filtered through cotton-wool will answer), and with a hard (H) pencil makes a series of innumerable fine dots and comma-shaped dashes, every touch of the pencil leaving behind a little blacklead, which will alter the character of the print.

Retouching as an art must be left to the professional, for long and constant practice, together with a knowledge of the anatomy of expression, are required to produce those smooth and beautifully modelled faces which we see in the show-cases. All that the amateur should attempt is to pencil out freckles and accidental spots, soften the shadows, and heighten the high-lights, as may be necessary.

The retoucher's maxim is—"It is possible to put in white, but not black," in the picture, but with care and skill it is possible even to "put in black." With a very sharp penknife the gelatine film may be *scraped* at any too dense spot, or a pointed piece of ink-eraser may be used to abrade the film and reduce its opacity. Another good plan is rubbing with chamois leather kept just moist with methylated spirit, and changed as it becomes black.

A negative can often be greatly improved by working upon the back. Objects projecting into the sky, such as church steeples, towers, etc., usually take much longer to print than the rest of the picture. For such cases cover the back of the plate with matt or ground glass varnish, and scrape out carefully the varnish covering the steeple, etc.

Or the back of the negative may be covered with tissue-paper strained on with a little gum (or, better, with the papers sold as *papier mineral* and *papier vegetal*), and on this we can work with the pencil, or apply plumbago with the aid of a stump. In a portrait, if the face prints too dark as compared with the rest of the picture, cut out a piece of paper to just cover the face, and when the features are all but sufficiently printed fasten the paper on the back of the negative, so as just to cover them. In this way a clever artist can effect a surprising improvement in a bad negative.

CHAPTER VII.

Positive Printing on Paper: Silver Printing.

72.—**Nature of a "Positive."**—The picture obtained in reduced silver on the surface of a gelatine dry plate by exposure in the camera and subsequent development is—as we have already pointed out—of a "negative" nature; white objects are represented by a black opaque deposit of silver; black objects are scarcely represented by any deposit of silver at all, the parts of the plate which their image occupies being consequently nearly transparent; while the half-tones of the original object—those which are neither quite black nor quite white—have caused the deposit on their part of the plate of enough silver to block out part of the light only, and are therefore represented by semi-transparent lines and patches.

Now, when we place a piece of paper coated with some substance sensitive to light *underneath* such a negative, and expose the whole to sunlight, the light passing easily through the transparent parts of the negative will produce a very marked impression on the paper beneath; passing less readily through the half-tones, it will produce less effect on the surface of the paper beneath them; while it will scarcely be able at all to get through the black patches which mark the high lights. The result will be the production of a correct image in various gradations of black and white on the sensitive paper. To such an image we give the name of a *positive*.

73.—**Sensitive Paper.**—The paper usually employed for the production of positive prints is made sensitive to light in the following way: It is first floated on a solution of albumen (white of egg) containing ammonium chloride, and is then dried. It is next floated for two or three minutes on a bath of silver nitrate (50 grains to the ounce), and is then again dried—of course, in a dark room. It is

then ready for use. The sensitiveness to light of paper prepared in this way is due to the formation of silver chloride, mixed with which there is also a slight excess of nitrate of silver. The latter salt serves another useful purpose, for it renders the albumen insoluble in water, and thus enables the coated paper to be freely washed. The albumen gives the surface of the paper a very glossy appearance; but it is sometimes dispensed with, when the paper is known as "matt surface." This matt surface sensitised paper is now sold commercially, and for architectural subjects it is certainly excellent, giving the print all the appearance of a fine engraving.

Sensitive paper prepared in this way must be used while fresh, as it becomes discoloured in a few days. But paper known as "ready sensitised" is sold at the shops, which is warranted to keep good for several months. Its exact mode of preparation is a trade secret. It is almost universally employed by amateurs, and, indeed, by many professional photographers also. It is believed that a little acid—citric acid, it may be—is added to the nitrate of silver bath as a preservative.

Sensitive paper is almost invariably sold in sheets measuring about 17in. by 22in. It can also be bought ready cut to any size. It is sold with the natural white surface, and also tinted mauve, pink, etc. For general work the mauve tint is to be preferred.

Ready-sensitised paper may be kept for years if it is laid between sheets of red blotting-paper which have been soaked in a solution of washing-soda and then thoroughly dried. Pressure must be applied—an old copying press answers splendidly—so as to exclude both air and light.

Sensitive paper should not be used "bone-dry;" or weak prints difficult to tone will be produced. A sufficient quantity of paper should be taken out for the day's use, and placed in a damp place—say a cellar—for an hour or two before using, but this need only be done if there is reason to believe that the paper is too dry. To obtain rich tones it is an excellent plan to *fume* the paper before using it. This is done by placing a saucer full of strong ammonia at the bottom of an air-tight box and pinning the

sheet of paper which it is desired to "fume" upon the lid, film side downward. The lid is then shut closely, when the ammonia fumes act upon the surface of the paper, and in about a quarter of an hour the process is complete. The paper should be used at once for printing, as the effect is not permanent.

All this is another argument for varnishing one's negatives. For although no harm will be done by taking a few prints on *dry* paper from a *dry* negative, yet when the paper is not perfectly dry (and we know that perfect dryness is inimical to the best results) the nitrate of silver in it will affect the negative, producing spots which will speedily ruin it.

74.—**Apparatus Required for Printing.**—To print the positive we must have a *printing frame* to hold the negative securely. The back of this frame should be hinged in the middle, so that either half of it may be turned up to examine the progress of the print during its exposure to light. *Pads* of felt or blotting-paper are often placed between the back and the paper, so as to increase and distribute the pressure of the springs by which the back is held down.

It is a good plan to *fume* the pads with ammonia by the method already described for fuming paper.

In winter, when the dull light makes printing slow work, and a negative sometimes takes days before a print can be obtained from it, the sensitised paper should be backed in the printing-frame with two or three thicknesses of blotting-paper which has been soaked in a saturated solution of common washing soda, and then thoroughly dried. This will prevent that discolouration of the sensitised paper which would otherwise take place.

75.—**How to Print the Positive.**—Place the negative in the printing frame, film side up, and lay the sensitised paper, coated side down, upon it. Next place the pad in position, and finally put on the back and press the springs into place. Now expose the glass to sunlight, placing it (best) in the open air, pointing to the sky, but not exposed to the direct rays of the sun. Very dense negatives, however, are best printed in full sunlight. If no

shady corner can be found, a piece of ground glass, or of tissue-paper, laid over the printing frame, will answer equally well.

During the process of printing, the sensitised paper should be examined every few minutes to see what progress is being made. For this purpose it should be taken indoors, and the one-half of the frame opened in the dark corner of a room. Great care must be taken *not to move the print* while it is being examined, or everything will have a double outline, giving the picture a blurred effect. The half of the frame which is not opened should be kept firmly pressed down with the hand while the other half is being opened, in order to prevent this. If the negative is thin, perhaps it will be done in five minutes; if very dense, more than a day may be required. But a good, average negative usually requires —in the summer months—from twenty minutes to half-an-hour in the shade. The picture must be printed *much deeper, or darker*, than the finished picture is meant to be, because the subsequent operations of toning and fixing will weaken it considerably. It is a good plan to continue the printing until the shadows, or darkest parts, have a bronzed appearance, while even the high-lights have become slightly grey. Experience, however, will soon teach the right depth. Over-exposed negatives yield prints grey all over, although showing plenty of detail. Under-exposure in the negative usually makes itself felt by producing hard prints void of detail, with large patches of black and of white.

A patch of nearly pure white in a print generally looks bad and obtrusive. A paper mask should be cut which will cover the entire print, and in this mask a hole should be cut which will just expose the glaring patch of white. Covering the print with this mask, and laying it upon some hard, level surface (as a sheet of glass), the print should be exposed to daylight for a few seconds, or until the white patch receives a perceptibly grey tint. With some very hard prints it is an advantage to "sun" the entire print in this way, as the hard contrasts are thereby reduced.

76.—**Printing in Clouds.**—Very few negatives will give a good print of both cloud and landscape. It is

usually best to have the sky so opaque that it prints white. If the sky prints grey, or mottled, it is best to mask it out by laying a piece of opaque paper over it during the printing; or by painting it over with black varnish or with gamboge. It is then possible to add suitable clouds from a second negative; this is one of the simplest forms of combination printing.

Cloud negatives may be specially taken for this purpose. The smallest stop should be used, and a very short exposure given—say a quarter of a second; or cloud negatives may be purchased from any dealer.

First cut a "mask" for the print by holding it up to the light behind a piece of red blotting-paper and roughly tracing on the blotting-paper with a lead pencil the outline of the sky. Then cut this mask out of the blotting-paper.

Place the print, face upward, on a clean board or square of glass. Lay the mask upon the print so as to be a little *below* the sky-line; indeed, any *dark* projections into the sky need not be covered at all, as the clouds will not show on them. Now place the cloud negative upon the print, and over all adjust your focussing cloth, or a duster, so that it roughly covers both the masked part of the print and the lower part of the sky. If the cloud negative is a paper one, it is useful to lay a sheet of glass upon the top of it, so as to press it down. Walk into the open air and expose the print in the shade, move the duster slightly, but continually, so as to prevent any harsh line showing, and for the last few minutes remove it altogether from the sky. After five minutes take the whole affair indoors and very carefully examine the progress. The clouds should be printed deeper than you wish them to appear in the finished print, as they will lose much in the subsequent operations of toning and fixing.

Next to employing a suitable cloud negative, the best plan of improving the plain white sky of a print is to give it a gradated grey tint, decreasing in depth from the top downwards. This can be readily done by laying the print upon something flat (as a square of wood), covering it with a sheet of cardboard, and then exposing the sky of the print to daylight by degrees, moving the cardboard slowly

downwards, and keeping it in constant motion to avoid any harsh lines.

77.—**Trimming the Print.**—When the print is removed from the printing frame, its margin will probably be irregular and more or less "ragged." Before toning the print, it is better to cut off this margin and leave it clean and rectangular; this trimming must be done in a dimly-lighted room, or if the room has yellow blinds, it will suffice if these are pulled down. In trimming we require a sheet of plate-glass, or a block of hard wood, or a sheet of zinc, on which to lay the print. The cutting knife must be sharp, and nothing answers so well as a sixpenny shoemaker's knife. A "cutting-shape" made of plate-glass, with smooth, truly cut, and polished edges, is also needed; although a T square, or even a common glass plate of the same size as the negative yielding the print, may be employed instead. The edges and corners of glass plates can be ground down and smoothed by rubbing them on emery paper moistened with turpentine.

Place the print face uppermost on the block, and adjust the cutting-shape upon it; then pass the knife all round it, and take especial care to cut it true and square. See also that any vertical lines in the print are parallel to the sides. Having removed the unsightly margin, look again at the print to see if it would be benefited by the removal of still more of its area. Perhaps a great part of the foreground consists of a bare grass field; if so, remove it at once. It is in such points as these that artistic knowledge and instinct come into play. There is far too great a tendency among photographers to regard every square inch of their prints as precious; while, in fact, it may be that half the print is better than the whole.

As the prints are trimmed, place them in a light box labelled "PRINTS READY FOR TONING." One of the boxes in which dry-plates of the size printed from are sold will be very handy for this purpose. A square of plain glass should be laid on top of the prints to press them down and keep them flat.

CHAPTER VIII.

SILVER PRINTING *(continued)*: TONING THE PRINT.

78.—**What is "Toning"?**—When the paper print is removed from the printing frame, its colour may vary from violet to red. It may be of a pleasing or unpleasing tint. But, however pleasing its appearance may be, it would not be possible to leave it in this state, for it is "unfixed," it still contains much unaltered silver chloride, and it is therefore still sensitive to light. If the print be fixed at once, without toning, its colour will change to a disagreeable foxy red.

The operation of toning is in fact the gilding of the image by depositing finely divided gold all over it. Gold in this state is of a black or purplish-black colour, and—since gold is a very permanent and unalterable metal—this toning or gilding also serves to preserve the picture.

79.—**Materials for Toning.**—To tone properly we require a white porcelain (or better, "granitine") dish, an inch or two larger in each direction than the print to be toned; and of a good depth, say two to three inches. The toning dish must be used for no other operation whatever. After use it must be well scrubbed out and left upside down to drain.

Gold for toning is usually purchased in little sealed glass tubes, each of which contains fifteen grains of chloride of gold, or about seven grains of the precious metal. When purchased the tube should be dropped into a glass stoppered bottle, and $7\frac{1}{2}$ ounces of distilled water added. The bottle should then be shaken until the tube breaks, when its contents will quickly dissolve in the water, forming a yellow solution. Two or three thicknesses of brown paper should be glued round the bottle to protect its contents from the light, and it should be labelled, "Solution of chloride of gold for toning; one grain of chloride of gold in each four drams of solution."

A good-sized stoneware dish in which to wash the prints will be required, and another containing water with a little common salt (about half-an-ounce of salt to a gallon of water). Large, deep pie-dishes or ordinary washing basins will answer very well for these purposes, but everything must be scrupulously clean.

80.—**How to Make Up the Toning Bath.**—The toning baths now almost universally employed are of an alkaline nature. The common test for alkalies is their power of turning red litmus paper blue. The toning solution, however, should be only just alkaline, so that the litmus paper ought to change colour very slowly.

The toning solution we recommend for general use is made up as follows:—

Chloride of Gold	1 grain
Borax	80 grains
Distilled Water	12 ounces

This quantity of gold will suffice to tone one sheet of sensitised paper, *i.e.*, about twenty-five quarter-plates, twelve half-plate prints, and so on.

Pour into a measure half-an-ounce of the chloride of gold solution (this will contain one grain of gold), and add to it a pinch of powdered chalk to neutralise any acid which may be present. Shake well, and then allow the chalk to settle down. Next dissolve the borax in six ounces of hot water, and when it is cool add to it, first, the neutralised solution of gold chloride, and then enough water to make the whole measure twelve ounces. Distilled water must always be used for making up the toning solutions. This borax toning bath works best about one hour after it has been made up, and it will not keep for more than a day.

81.—**Operations in Toning.** — Immerse the trimmed prints in a large dish full of tap water, and move them to and fro. In a minute or less the water will have become milky, and must be poured off and fresh water added. This operation must be repeated five or six times. The milkiness is due to unused chloride of silver washed out of the paper. The prints will look quite red after this preliminary washing. Now place the dish—still full of water, in which the prints are floating—by the side of

the dish containing the toning solution, and immerse the prints one by one in the latter, face downwards. Not more than four or five prints should be in the toning dish at once, although practised manipulators may perhaps manage twice as many. It is important to have the toning solution at the right temperature—between 60° and 70°F. If it is colder, the prints will only tone very slowly. To secure this temperature in cold weather, the toning dish should be warmed, and the solutions made up with tepid water.

Keep the prints in frequent motion while toning, taking out the bottom one occasionally and laying it on the top; the dish should also be rocked. After a few minutes the prints may be turned over and examined to see what progress they are making. Slowly their hue changes from red to brown; then to purple and black; and finally to a slaty colour. It is generally best to continue the toning until a dark purple or bluish-black has been fully obtained, and the average time to produce this is about fifteen or twenty minutes.

There are some brands of ready-sensitised paper, however, which will give brown tones only; and unless the negative is a good one, it is quite impossible to obtain on any paper the rich purplish-black tints which most people admire in a photograph. No one has yet been able to *explain* why the negative should affect the print in this way; but it is an undoubted fact, and offers another reason why we should try above all things to secure a good negative to begin with.

It is much easier, however, to get black tones with freshly sensitised paper than with that sold as "ready sensitised"; in fact, there are some brands of the latter in the market with which it is impossible to get black tones.

It is rather difficult to judge exactly the right moment when to remove the prints from the toning bath. It is best to conduct the operation in a dull white light (keeping a cover over the toning dish as much as possible), because it is then easier to judge the hue of the prints than by the yellow light of gas or candles. It is a good plan to hold up the prints between the eye and the light, and if the least trace of red or brown can be detected they should be toned a little longer.

When the process is considered to be finished the prints should be removed, one by one, to the dish of salt water (the salt stops the further action of the toning solution on the prints).

When all are finished the prints must be removed to a dish of fresh water, and the whole well rinsed out two or three times under the tap.

During the whole process of toning it must be remembered that the paper is still slightly sensitive to light, so that the light must be subdued and the prints kept covered over as much as possible.

82.—**Brown and Purple Tones.**—If a rich brown tone is specially desired, the prints may be soaked *before* toning in salt water (one ounce to the pint), but they must be well washed in clean water after this, and before immersion in the toning bath.

It is of great importance to prevent even a trace of the hypo solution getting into the toning bath, for if this happens the toning action will cease at once. The toning and the fixing dishes ought to be kept on separate tables, and if the fingers are once dipped in the hypo, they should be well scrubbed with soap and water applied by a nail-brush before immersing them in the toning solution again. A little of the toning solution will, however, do no harm to the hypo bath.

Purple tones are more easily got if one of the waters in which the prints are washed before toning contains a little washing soda (say half-an-ounce to the pint); this will neutralise the acid which is always present in the "ready-sensitised" papers. The toning should always be carried a *little* beyond the desired colour, as the prints lose somewhat in the operation of fixing.

CHAPTER IX.

Silver Printing *(continued)*: Fixing and Washing the Print.

83.—**Preliminary Washing of the Print.**—After the print is properly toned it should be well washed in three or four changes of water to remove the excess of toning solution which clings to it. Neglect of this precaution will render the print more liable to fade.

84.—**How to Make the Fixing Bath.**—By "fixing" or "clearing" an ordinary silver print the photographer understands the removal of all the silver salts from the print which do not take part in the formation of the image, and the reduction of the material which forms the image to the state of black metallic silver. In every unfixed print there is a large amount of such unused chloride and nitrate of silver. If these were allowed to remain in the paper it would gradually darken on exposure to light, and all traces of the picture would ultimately be lost. Several substances might be used to effect this "fixing," but hyposulphite of soda (hypo) is now universally employed for the purpose.

The hypo solution made up as described (paragraph 55) for fixing negatives will also answer for fixing prints. Its strength—4 oz. of hypo to one pint of water—is rather too strong, however, for paper prints, and it will be best to dilute it for this purpose with an equal bulk of water. Thus the fixing bath will consist of

Hyposulphite of Soda	2 ounces
Water	20 ounces

which is practically a ten per cent. solution.

The hypo bath should be just tepid, say about 60° F. In winter it should be warmed by the addition of hot water (in diluting the strong solution) so as to bring it to about this temperature. It is, indeed, of importance in

photography to have all the solutions employed at about an equal temperature, and if that temperature can be 60° F. so much the better. Above 70° will be found too hot, and below 50° too cold.

The fixing dish should be large and deep, able to hold about a pint of the fresh hypo solution, which will suffice to fix a sheet of paper of the ordinary size (17in. × 22in.)

85.—**Fixing the Prints.**—Take the prints out of their last washing water with one hand, and drop them into the hypo, pressing them down and moving them about with the other. Do not try to fix more than half-a-dozen prints at once, and not so many as this if they be of large size—whole-plate or over. Rock the hypo dish gently, and from time to time draw out the bottom print and lay it upon the top one. If the prints are allowed to remain at rest they will stick together, and yellow spots or patches will be the result. The time required for fixing is not very long, but it is much the best to err always on the right side, and to give the prints not less than twenty minutes. It is not so easy with prints on paper as with glass plates to tell when they are thoroughly fixed; but a pretty fair idea can be got by holding each print between the eye and the light, when it ought to appear translucent and free from spots. Those who wish to make sure of the permanency of their prints should use *two* hypo baths, and give the prints fifteen minutes in the first and ten minutes in the second bath. As soon as the first bath becomes discoloured, and its powers begin to be spent, it should be discarded and thrown away, and the second bath used in its place, a new second bath being then made up. The same hypo solution must *not* be used for a second lot of prints at a subsequent time. It may, however, be filtered into a bottle, and kept for fixing negatives. As noted before, the hypo for fixing ought to be slightly alkaline to test papers. The fixing bath ought to have ammonia added to it, drop by drop, until it just smells of the alkali.

86.—**Washing the Prints.**—When the prints are considered to be thoroughly fixed, they must be removed from the fixing bath one by one, and immersed suddenly in a large vessel of clean water. They should be rinsed

well in this, and fresh water poured on them three or four times. In this way all the hypo which clings to the face and back of the print will be got rid of. But there is hypo also within the pores of the paper, and it adheres with wonderful obstinacy to every fibre. The great problem is how to get rid of it as speedily and effectively as possible. This must be done if we desire the photograph to have any degree of permanency. Imperfectly washed prints turn yellow and fade in a few months, or even weeks.

For those who have the time and the will there is no better method than the following: Lay the prints, one at a time, on a sheet of plate-glass or slate, and let the tap play on each side freely. A "rose-tap" is very useful for this purpose, and for washing negatives also. The print should be well sponged or rolled with a soft rubber roller, the object being to squeeze as much of the hypo solution out of the pores as possible. The print can then be allowed to soak in clean warm water while the others are being dealt with, after which the sponging, etc., must be repeated five or six times. In this way it is possible to free the prints from their whilom friend, but present enemy, in about three hours.

The more usual plan is to place the prints—a dozen or so at a time—in a large stoneware vessel, or enamelled or japanned metal dish, provided with a syphon to draw off water from the bottom. Water is allowed to enter the vessel either through a fixed pipe or by an indiarubber tube connected with the tap, and the prints are left to "wash" all night, or for about twelve or fifteen hours. This is a good plan if we can prevent the prints sticking together, which they always seem to have a great tendency to do. If it is done in the daytime the prints can be separated by the hand every half-hour, but this is not possible in the night. Many washing-troughs have been invented, some of which answer their double purpose of changing the water and keeping the prints apart and in motion fairly well.

Very long washing—twenty-four hours or more—affects the brilliancy of the prints, and tends to decompose the

albumen. For these reasons a very prolonged soaking or washing is not to be recommended.

But unfortunately, even if the greatest care be taken in the washing, it would be unsafe to warrant any silver print —more especially those on the ordinary albumenised paper —as *permanent*. Although silver printing has now been practised for nearly half a century, there is probably not a silver print in existence which, being more than ten or fifteen years old, retains its pristine brilliancy and purity. Let it be granted, however, that a few such specimens could be produced, yet the fact remains—and it has done immense harm to photography—that the process by which nine-tenths of the photographs now in existence have been, and are being produced is unreliable in the extreme so far as the permanency of its results is concerned.

The public taste has been educated to like a photograph upon glossy albumenised paper containing chloride of silver, but during the last few years other printing processes have come into vogue and are steadily gaining ground, which can be guaranteed with much confidence to give pictures that shall be at least as enduring as the paper upon which they are printed (and more cannot be demanded or obtained). Among these permanent printing processes we may name bromide paper (see Chapter XIV.) and the platino-type process, in the latter of which the image is produced in black metallic platinum upon plain paper, the metal platinum being one of the most unalterable substances with which we are acquainted.

Those who wish to preserve the brilliancy of their photographs should protect them as much as possible from gas, air, or sunlight. They should be kept in tightly-clasped albums, or in air-tight frames.

CHAPTER X.

The Finished Print: How to Dry and Mount it.

87.—**Drying the Print.**—When the prints are considered to be sufficiently washed they should be removed, one at a time, from the water, and laid between sheets of clean red blotting-paper. Red blotting-paper is to be preferred, because the white is often bleached by the aid of hypo, the very substance which we desire to keep as far from the finished print as possible. By removal from one sheet of blotting-paper to another, and by laying a board with a weight on top of it upon the paper, the prints will be quickly made as dry as is necessary. It is not well to dry the prints too thoroughly, as they then curl up like pieces of watch-spring, and are much more difficult to handle.

88.—**The Mounting Solution.**—Starch is a favourite medium for mounting prints, but the following is to be preferred because, for one thing, it does not "cockle" the mount so much.

Allow one ounce of hard gelatine or of best glue to soak in water until it is quite soft and swollen. Now remove the gelatine to a large glass beaker or porcelain vessel (a jam-pot will answer very well), and immerse it in a saucepan half full of water. Stand the saucepan on the fire, and as the water gets hot the gelatine will quickly liquefy. As it melts stir in by degrees a quarter of an ounce of glycerine, one ounce of water, six ounces of methylated spirit, and ten drops of carbolic acid. Mix the whole thoroughly together and pour it into a bottle or stoppered jar. As it cools it will solidify, and when required for use it must be melted by immersing the jar in hot water. If it works too stiff a little more methylated spirit may be added.

This is known as an "alcoholic mountant"; when cold it looks like a stiff jelly. It can be bought ready prepared.

89.—**Mounts for Photograph.**—By a "mount" we understand the support upon which the photograph is to be permanently fixed. Cardboard is the commonest material of which mounts are made, and it is most important that it be free from the injurious substances ("hypo" for example) which are employed by many paper manufacturers. For this reason cardboard mounts should always be bought from a respectable photographic stock-house, as those required for mounting photographs are specially made for that purpose.

Portraits, cartes, cabinets, etc., usually look best when mounted on a dark-coloured enamelled card, showing but very little margin, and having a gold bevelled edge. Mounts for views, on the contrary, should show a good margin, say two or three inches for half-plates, and may be of a "Silurian blue," French grey, or cream tint.

Loose mounted prints may be conveniently kept in light wood or cardboard boxes, such as the "Stone's boxes" now so largely used for storing documents, etc., or they may be kept in portfolios.

It is also a good plan to keep two albums. In the first of these a print from *every* negative should be inserted, with full particulars written beneath each. This store-book, or stock-book, will be most useful for reference, and as pointing out causes of failure, etc. The second may be a "show album," to contain prints from good negatives only.

90.—**How to Mount Prints.**—Provide mounts, mounting solution, round hog-hair brush, two-foot rule, lead pencil, sponge, and some sheets of clean red blotting-paper. Taking the first print, lay it upon the mount, and adjust it to the desired position. If the margin is wide, measure it on each side, and also at top and bottom, to be sure that the print is in the centre of the mount. Then mark the position of the two upper corners with the lead pencil. Remove the print and lay it face downwards on a sheet of blotting-paper. With the round hog-hair brush (which is far superior to a camel-hair brush, since the hair seldom comes out), coat the back of the print quickly and lightly with the mounting solution. Adjust the corners of the print to the marks on the mount, and press it down. Now

place a piece of blotting-paper upon the print, and rub smartly from the centre outwards, so as to get rid of any air-bubbles. With the alcoholic mountant recommended it is almost impossible to get the prints off after they have once touched the card, therefore use care, and remember that practice is necessary to success. The mounting solution ought to be kept hot, and more spirit and a little water added to thin it as required.

A capital way of mounting is to use *cut-out* mounts, the opening being just the size of the picture to be shown. The prints should not be trimmed, but affixed by the margins only to the back of the mount. A second sheet of thin cardboard may be glued on at the back to protect all, if desired.

91.—**Pressing the Prints.**—The mounted prints should be laid on any smooth, hard, level surface, one upon the other, with pieces of blotting-paper between. On top of the pile lay a smooth piece of wood, and on this put as heavy a weight as you can conveniently place there; one or two 56lb. weights answer capitally. Leave the prints under pressure for a few hours (all night is best), and they will be found very flat and smooth.

92.—**Spotting, Touching, etc.**—At its present stage the print should be "looked over," and any obvious defects remedied as far as possible. There may be white spots of all sizes, defective patches, etc. Mix up with a little gum-water, some Indian ink, and light red (or rose madder), so as to imitate the tone of the print, and apply it with a fine-pointed red sable brush. To make the colour "take" on the albumenised surface it is usual to wet the print with the tip of the tongue. Great care is needed in spotting, but those who have had some artistic experience may go even further and "mend" any defective places in the print.

A little very dilute solution of ox-gall also makes the colour adhere admirably to the paper, but it must be mixed only in small quantities and just before use.

93.—**Rolling or Burnishing.**—To put a fine surface or "finish" on a print it is usual to pass it through a rolling-press, which may either consist of two steel

rollers or of a roller and a metal plate. In some rolling-machines one of the rollers can be heated by gas or otherwise.

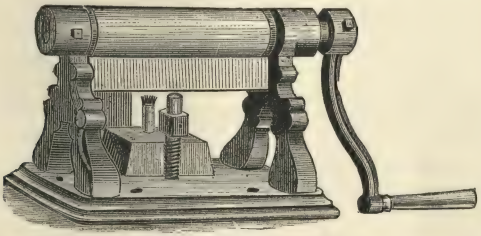

Fig. 10.—Rolling press, to cause the print to adhere firmly to the mount, and to give it a smooth level surface.

In a burnisher we have also a steel roller by which the print is rubbed or dragged over the surface of a hot bar of burnished steel. This puts an extremely high gloss upon the prints. Prints to be burnished should previously be lubricated by rubbing on a solution of Castile soap (three grains) in methylated spirit (one ounce) applied on flannel.

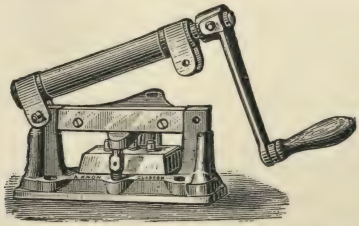

Fig. 11.—Burnisher, used to give the print a highly polished surface.

Such machines are, however, rather expensive. Most professionals are willing to burnish prints for amateurs at a very moderate charge; but the sooner the prints are burnished after mounting and pressing the better. Portraits are, perhaps, improved by burnishing, but for general subjects the high polish thereby imparted is certainly inartistic. All prints should, however, be rolled; because they are thereby made to adhere with great evenness and uniformity to their mounts.

94.—**Framing Photographs.**—Finally, let every photographer learn to frame his own pictures, and then he can beautify his home at a very moderate expense indeed. The tools required are a tenon-saw, mitre-block, bradawl and hammer; and the materials—some oak moulding, gilt beading, "backing," brads, sandpaper and glass (16oz.) With these, and a little "handiness" and knowledge of home carpentry, framing becomes a pleasant pastime.

CHAPTER XI.

Outdoor Photography: Landscape Taking.

95.—**What to Photograph.**—To the beginner we say—photograph everything which is near at hand, but commence with inanimate objects. Photography is largely a mechanical art, and to become acquainted with the sequence of the necessary operations, and the mode of performing them, a good deal of practice is necessary. Therefore photograph your house, your neighbours' houses, all the objects in your garden, your arbour, your back door, anything and everything, so as to expend your first three or four dozen plates. Your experience you must buy, and by working a small-sized plate for the first year or so you will buy it cheaply.

In this way you will learn how to manipulate your apparatus; how to mix your chemicals, develop and fix your pictures, etc., etc. It is very improbable that you will get any results which an experienced photographer would consider worth keeping. But what of that? You are steadily and quickly acquiring the practical rudiments of the art.

Above all things do not attempt any "portraits" or "instantaneous" pictures during this stage of your (photographic) existence. Use slow (landscape) plates, and give long exposures.

96.—**Copying.**—We apply the term "copying" to the reproduction by a photographic process of any painting, engraving, drawing, etc.; in fact, to the production of a flat copy from a flat copy. For practice select some bold woodcut, and pin it upside down upon a drawing-board. Place the drawing-board on an easel, or support it in some way in a vertical position, facing a window (a north light is always best), and not more than eight or ten feet from it. Place the camera between the board and the window, and at right angles to the board (the board and the

camera should be moved sideways a little, so that the shadow of the camera does not fall upon it), and support the camera by a table, books, etc., so that the lens points exactly to the centre of the woodcut. Now focus correctly, and move the camera nearer or farther from the board as may be necessary in order to get the whole of the woodcut upon the ground-glass. For copying purposes a wide-angle lens and a long-focus camera are desirable. To obtain a copy of the same size as the original, a camera which will extend to at least twice the focal length of the lens employed is necessary. A slow plate should be used, and a long exposure given; say, for a trial, half-a-minute with the stop marked $\frac{f}{16}$. In copying paintings, the reds and yellows will be reproduced as black by an ordinary plate; but if an *isochromatic* plate be employed, these colours will be represented in nearly their proper gradation of comparative lightness. These isochromatic plates are prepared by the addition of a dye known as *eosine* to the emulsion of gelatino-bromide of silver with which our dry plates are coated. The effect of this dye is to render such plates much more sensitive to yellow and to red light than ordinary plates. They require, of course, great care in development, and it is best to wrap two or three thicknesses of brown tissue paper round the ruby lamp, and to expose the isochromatic plate to even that weak light as little as possible until development is well advanced. After the plate has been immersed for three or four minutes in the developing solution, it is far less sensitive to light than when it was first put in.

97.—**Selection of Subjects.**—In photographing any place or object it is a great advantage to have seen it before. Our best landscape photographers never think of photographing "at sight." On visiting any new district they devote the first day to walking round and noting the objects they desire to photograph, looking at their position, and entering in their note-book the time of day at which the light will be most suitable. Then on the second day they follow a duly-considered route, and get many more pictures, and far better ones, than if they had gone aimlessly and unknowingly about, camera in hand, for the two days.

98.—**Position of the Sun.**—In deciding the best time of day at which to photograph any given landscape or building the relative position of the sun is of the greatest importance. The direct rays of the sun must never be permitted to enter the lens; if they do the plate will be "fogged" and ruined. Therefore do not point the camera facing the sun; or if you are compelled to do so, contrive some shade for your lens which will keep out the sun without coming into the field of view. The hat is often used for this purpose, but a proper lens-shade, consisting of a flap or half cone of blackened card adjusted over the lens, is much better.

Neither is it well to have the sun behind the camera. In this position the broad effects of light and shade are lost, and the picture appears flat.

Let the sun, then, shine from either the right or the left hand—from one side or the other—upon the object you

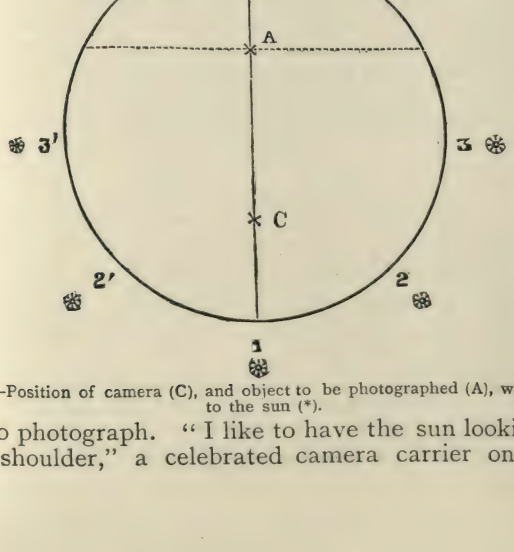

Fig. 12.—Position of camera (C), and object to be photographed (A), with respect to the sun (*).

wish to photograph. "I like to have the sun looking over one's shoulder," a celebrated camera carrier once said.

Thus, in the accompanying diagram, where A represents the object to be photographed, and C the camera, the best general position for the sun would be at (3) or (3′), and the next best at (2) or (2′). With the sun at (1) the picture will look flat; anywhere near (5) there will be danger of fogging the plate. For some objects, such as sheep, etc., a brilliant effect can be obtained with the sun at (4) or (4′). The light then skims the edges of the objects, and depicts them with surprising force. This is a favourite effect with H. P. Robinson, but it needs handling with care.

99.—**Marking the Ground-glass.**—The ground-glass screen of every camera ought to be so marked that vertical and horizontal lines can be seen at a glance. The inter-section of these lines should mark the (artistically) strong or *forte* points of the picture. The centre of the screen should also be marked. This may be done in the following way: Turn the screen over so that the ground side of the glass is outward; divide it each way into three equal parts, and connect these by lines drawn with a fine-pointed lead pencil; find the centre of the screen also by placing the ruler along the diagonals, and mark it with a cross; describe a circle from the centre with a radius of one-and-a-half inches; this will show how much of the picture can be used for making lantern slides by contact-printing. The focussing glass will then present the following appearance:—

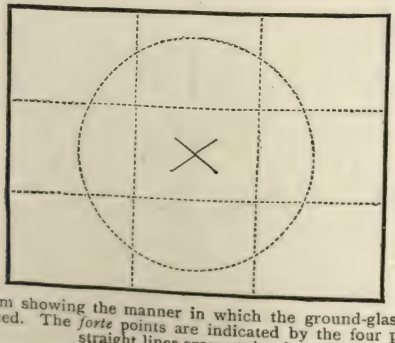

Fig. 13.—Diagram showing the manner in which the ground-glass of the camera should be marked. The *forte* points are indicated by the four points where the straight lines cross each other.

100.—**Setting up the Camera.**—Put the tripod together, and place it with the three legs a couple of feet apart firmly upon the ground, with one leg pointing to the object to be photographed; then screw the camera on the top of the tripod. Now level the camera; rack out the lens to somewhere about the correct focus (this should be marked on the side of the camera for near and for distant objects respectively) and throw the focussing cloth over it. The lens should be left with "full aperture," *i.e.*, no stop at all should be inserted to commence with.

101.—**Adjusting the View on the Ground-glass.**—Placing the head beneath the focussing cloth and keeping the eyes eight or ten inches distant from the ground-glass, we see an inverted coloured image of the object upon the screen. With one hand upon the rack or screw we work the camera in or out until the picture looks fairly "sharp;" then loosening the tripod screw we turn the camera to right or left until it includes, laterally, the objects we desire to photograph. From its general appearance we can now decide whether the picture will look best with the longer diameter of the ground-glass placed horizontally or vertically; it is generally easy, however, to determine this before setting up the camera, and to fix the instrument accordingly.

If we are taking a landscape we now take hold of the front leg of the tripod, and either draw it towards us or push it away according as we want less or more of the foreground to appear on the screen. When the picture appears to our satisfaction on the ground-glass we once more focus it as sharply as possible, using the magnifying glass (if we have one) on some prominent object situated in the middle distance, and about half-way between the centre and the edge of the picture. The fact that the image is inverted both vertically and laterally makes its study upon the ground-glass somewhat difficult; but the difficulty is soon removed by practice. Holding the head sideways is an aid in removing the effect of the "upsidedownness"; and we must remember to look on the *right-hand* side of the ground-glass for objects which are on the left of the view that is being taken, and *vice versâ*.

By using the swing-back, and drawing the top slightly towards us, we can improve the focus of objects in the foreground without materially interfering with the sharpness of objects in the distance, but this power should only be used sparingly, as the undue extension of the swing-back gives a false effect to the perspective of the picture.

102.—**Taking a Landscape.**—The camera being ready we cap the lens, insert the proper stop ($\frac{f}{32}$, or the medium stop answers well), take out or throw back the ground-glass, insert the dark slide (protected by the focussing cloth) in its place, pull out the slide, shade and uncap the lens ; and expose for a length of time which must be determined by our experience and by the use of exposure tables, but which for an ordinary English landscape scene may be, say, two seconds.

This done, we put on the cap, push in the sliding-shutter of the dark slide, remove the slide and return it to our case, replace the ground-glass and remove the stop ; we are then ready to take another picture.

103.—**Uses of Rising and Falling Front.**—Suppose that we are engaged in photographing a subject containing vertical straight lines, or some building, a church, etc. If we tilt the camera in order to get the top of the building or the spire of the church on the plate, the straight lines will not remain vertical on the ground-glass. To prevent this the first thing we should do with such subjects is to put one arm outside the cloth and use the *rising front*, moving the lens upwards as far as it will go, or as far as is necessary. The rising front is also often useful in cutting off part of an unduly extended or obtrusive foreground.

Sometimes we may require the front to move downwards or *fall* instead of rising, as when photographing from an elevation, as the top of a cliff, or on a hill, or a church tower, so that it is useful to have the front made to move both ways.

In cameras with conical bellows (Kinnear form) the edges of the bellows or the edge of the permanent wooden front sometimes interfere with the rays of light passing through the lens, if the front is moved too much. The lens,

too, should do more than just cover the size of plate to be employed, else when it is raised or depressed two of the corners will be left as bare glass.

The best cameras have a double front which allows the lens to be moved sideways as well as up and down. It is easy, however, to secure this side motion by loosening the tripod screw and moving the camera as a whole.

Some cameras, however, have no means of taking a picture vertically, or the long way of the plate, except by turning the camera over on its side, which is provided with a second hole for the insertion of the tripod screw. In such a case the double-action front is a necessity, for the side or lateral motion of the front becomes a vertical one when the camera is turned on its side.

104.—**How to Use the Swing-back.**—In the most elaborately-made cameras the swing-back has a double movement—a vertical, and a lateral or side swing. The latter is rarely required, though it is useful in street views, or in any case when objects on one side of the picture are much nearer than those on the other.

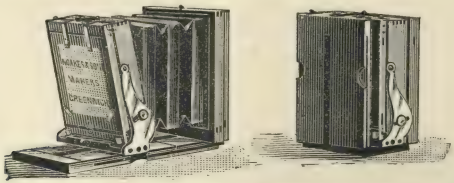

Fig. 14.—Camera, showing use of swing-back when taking portraits. Also camera closed up.

In portraiture the vertical swing is often useful in allowing a larger stop to be used than could otherwise be the case. This is done by focussing for, say, the face, and then pulling the top of the swing-back toward you until the knees (in the case of a sitting figure) are also in focus. The nearer an object is to the camera the farther back will its image be formed, behind the lens. Now, in the case imagined, the knees are nearer to the camera than the head, so that by pulling back the top of the ground-glass we get the knees in focus on the top of the creen (the

image being inverted) while the head is also in focus on the lower part.

In photographing buildings it sometimes happens that the use of the rising front alone does not suffice to bring the top of the building upon the ground-glass. In such a case it may be necessary to tilt the camera. To remedy the distortion so produced, we must push the top of the swing-back *forward* until the ground-glass is once more vertical. But this throws the picture partly out of focus, and we must use a small stop (say $\frac{f}{45}$ or $\frac{f}{64}$) to get it sharp all over again.

Never resort to the use of the swing-back unless it is absolutely necessary. Often by choosing another point of view, or by going a little farther back, or by ascending to a window or to the top of some adjoining building, we can dispense with its services. Still, vertical straight lines must always be correctly represented; nothing looks worse than to see a building apparently suffering from the effects of an earthquake, with its walls "all at sixes and sevens."

CHAPTER XII.

Out-door Photography *(continued)*: Composition of the Picture.

105.—**Planes of the Picture.**—Gazing upon any ordinary landscape or view, the picture usually divides itself into three parts, or planes, situated at different distances from the eye.

First we have the *foreground*, close to our feet and extending from us for a variable distance, say to twenty or fifty yards or more.

Beyond this comes the *middle distance*, in which should be situated the most important object in the picture—a ruin, mansion, a group of fine trees, etc.

Further off still, and extending as far as the eye can reach, lies the *extreme distance*, or background.

106.—**Arrangement of the Picture.**—The painter possesses some immense advantages over the photographer. All that is unpleasing and unpicturesque in the scene he can *omit;* while he can *introduce* features which would add to the beauty of the landscape if they were really present. Moreover, he can *combine* two or more of his planes, painting in first a pleasing foreground from one spot or district, and then adding his middle distance, etc., from another; he can also introduce figures where and as he desires. It is true that, by the difficult process called combination printing, the photographer can do something of the same kind, but the mechanical difficulties in the way are much greater. If the foreground is flat and bare it is often possible to improve it by dragging into position some suitable object, such as a boat, the trunk of an old tree, or even a wheelbarrow, etc. It is of great importance that this, the front plane of the picture, should be broken up, diversified, and interesting. By changing the position of the camera even a few yards it is often possible to improve the foreground by introducing bushes, stones,

etc.; the photographer should, therefore, look carefully round before finally deciding on the exact spot from which to take the picture.

Now for the main object of the picture. This should never be placed exactly in the centre; for the centre is, as artists know well, the weakest point of the picture. The "strong," or "*forte*," points lie along a line drawn about one-third of the height of the picture from its base (see paragraph 99) and at a distance of about one-third the length from either end. A skilful painter would place some object attractive to the eye—as a fine tree—at one of these points, and this he would balance by some smaller objects, perhaps a group of children, at the other point.

107.—**Position of the Horizon Line.**—The picture should never be divided into two equal parts, either horizontally or vertically. For this reason the best place for the horizon line (which must always be parallel to the base) is at either one-third or two-thirds the height of the picture. All other straight lines parallel to the base are to be *avoided;* bridges, canals, rivers, buildings—take them all from an angle; if they run straight across your picture from one side to the other, the effect is disastrous.

108.—**The Wedge Form of Composition.**—The "wedge" is a favourite form of composition for a picture—a mountain running down to a stream, a sea-cliff, etc. In such cases remember that the wedge needs supporting near its point by some smaller but striking object, as a cluster of dark trees on the banks of the stream, a ship on the sea, etc.

So, too, the slanting lines in a picture should never all slant one way, else everything will seem to be tumbling out of the picture. Suppose it be some fishing-smacks aground, all their masts leaning on the same side; get one or two of the smaller smacks turned over, and let some of the boatmen lean the contrary way to the general slant of the masts.

109.—**The Pyramidal Form of Composition.**—Objects of equal height occupying a line across the picture are to be avoided. Tall objects should be placed centrally (though not in the exact centre), and supported

or balanced by smaller objects on the sides. This is the pyramidal form of composition. It is very useful in groups, the figures in which should be disposed so as to form pyramids within pyramids as it were. In the foreground we may place the younger or smaller members of the party, kneeling or sitting upon the ground; behind them may be a row seated upon chairs, benches, etc.; while standing figures may form a third row behind. When the number in a group does not exceed three or four, it is possible to place them so that they seem to be naturally engaged in some suitable occupation, as chess-playing, reading, etc. But with a large number it is rarely possible to do more than arrange them in three or four rows as described above. Still, by the adoption of the principle of the pyramid, and by using judiciously the diversities offered by clothing, sex, etc., it is possible to get a passable result.

110.—**Introduction of Figures into Landscapes, etc.**—Nothing adds more to the interest of a photograph than the introduction of suitable figures in a judicious way. We may lay down three principles with regard to them: they must be suitably placed, suitably dressed, and suitably employed. If figures are to be subsidiary to the picture they must not be too near the camera; if they are to appear "at home" they must be suitably dressed—rustics in a rustic scene, in ancient garb if posed on a ruin, etc.; and never let your "models" look at the camera, or appear conscious of its presence. A waggon upon the road, a fisherman whipping the stream, a countrywoman with a bundle of sticks—these are grand aids to composition, but great judgment is needed in their use. Never allow part of a figure only to be included in a landscape; the trunk and head of a person, with no legs visible to support them, is simply ridiculous, or at least only less so than the legs without the rest of the body would appear.

111.—**Photographing "Interiors."**—Very charming results can be obtained with the camera by securing pictures of favourite rooms, of the interior of public buildings, museums, etc., or—best of all—of the naves, altar-screens, etc., of cathedrals and churches.

In taking the interior of an ordinary drawing-room a wide-angle lens will probably be required, and the camera should be levelled with care, or distortion of the vertical lines will be easily produced. To get in as much of the room as possible it is often advantageous to place the camera outside the room, in the passage, with the lens pointing through the door. If any windows are included in the field of view their curtains should be drawn down during the greater part of the exposure, or they will appear in the print as if surrounded by a halo of light, an effect which is termed halation. To prevent this altogether, or in part, it is advisable to *back* the plates which are to be used in photographing interiors.

This "backing" is effected by pouring a little black varnish—made by dissolving bitumen in benzene, or the varnish sold as Bates's Black will answer—on the back of each plate, and allowing it to dry before putting the plates in the dark slides. This backing must be removed by scraping it off with a broad chisel before development.

Cloudy or dull days usually offer better opportunities than intense sunshine for taking interiors, for the lighting is then more uniform, and the brilliant spots of light are absent which a bright sun sends through lofty windows. Thus rainy days, on which landscape work is impossible, can often be utilised inside some ancient building.

In order to get sharp details a small stop—$_{32}^{f}$, or less—is generally used in taking interiors. With the stop named and a rapid plate an exposure of about 15 minutes will suffice for the nave of an average church; while for a well-lighted drawing-room half as much will be ample. In interiors especially it is well to err on the side of over-exposure, and to develop very slowly, and with a very weak developer. If the interior is dark and gloomy, an exposure of one or even of two hours may be given. In such cases the task of focussing may be facilitated by placing a lighted candle or newspaper in some conspicuous place, and focussing on that. On the polished floors of many buildings the tripod legs are apt to slip. This may be prevented by fitting a piece of cork or of indiarubber tubing on the end of each

tripod leg, or by connecting the points of the legs with a piece of stout string.

112.—**The Photographic Season.**—Photography is possible, and is indeed practised during every month of the year. But the winter fogs terribly handicap the professional portraitists in our towns, and they render landscape photography practically impossible. Still, winter yields many effects which are peculiarly its own—snow scenes, frost and rime effects, for instance. These require a longer exposure than we should at first, perhaps, consider necessary;* they should be developed with a small proportion of pyro, say half a grain to the ounce, until the detail is brought out; a stronger developer may then be applied to finish with, if more density is required.

The "season" for out-of-door work may be considered to extend from the 1st of March to the 31st of September. The sun often shines with considerable actinic force in March, but these bright intervals are usually few and far between.

In April, when the air is cleared of dust by showers, and the sun shines forth brightly, instantaneous effects may be attempted. Still, June, July, and August are the photographer's three favourite months, and perhaps as many landscape negatives are secured in August as in any other three months put together, for that is the general "holiday month," and the camera is seen on every beach and in every glen. The early hours of the day—say from seven to ten—are the best for landscape work; the air is then clearer, and the low sun gives better masses of light and shade. Trees are often taken well by the late evening sun, whose low beams illumine their trunks. The chemical effect of the solar rays depends in the first place on the height of the sun above the horizon. It may be roughly stated that the necessary exposure for any subject in December is four times that required in June.

*Example.—Plate of medium rapidity, with stop f/32, sun shining, five seconds gave a good negative.

CHAPTER XIII.

Home Portraiture.

113.—**Why We Take Portraits.**—The professional photographer takes portraits for money—he has his living to get. Now, there are some "half-and-half" amateurs who also make a charge, "just to cover the cost of the chemicals, you know," but we confess that we have but little sympathy with them. The average professional has had hard work to make both ends meet this last year or two, and such competition is unfair to him.

The true amateur is one who takes portraits solely with the object of giving pleasure to his friends, to himself, or to both.

It is true that the demand for copies is often a serious tax on the time and purse of an amateur; but all this may be avoided, and the professional aided instead of injured, if we follow the example of a distinguished Leicestershire amateur, and refer our friends to some modest worker in our neighbourhood to whom we lend our negatives, and who will be only too pleased to print from and supply copies at a fair price.

114.—**Preliminary Practice.**—Never begin the practice of photography by attempting portraits. Expend first a few dozen plates on out-of-door objects, which can be trusted to keep still—as houses, churches, etc.—and which are not likely to find fault.

But it is probable that the photographer's friends will not give him much peace—supposing them to be young and innocent—until he has turned his camera upon their visages, and although the results may, and pretty certainly will, cause them much anguish, yet it is only by practice that we can hope to rise to passable results.

But even here preliminary practice upon some inanimate object will be very useful. If we possess, or can borrow or buy, a plaster or marble bust, it can be placed in different

positions and photographed, and the study of the resulting pictures will be of the greatest service.

115.—**Lighting the Figure.**—In a studio a large part of both roof and walls is usually of glass. This glass is covered with curtains of varying degrees of opacity, and these are so arranged on rods that they can be moved at will by the operator, who can thus throw just the light which he desires upon the sitter. But in "home work" we have not these facilities at hand; still it is left to us to make the best of what we have.

A north light is the best. In indoor portraiture, if we are compelled to use a room facing the south, the window should be covered with white tissue-paper, which will give a soft and diffused light.

In the next place, the light should fall upon the sitter from an angle of about 45 degrees; *i.e.*, just about half way between a vertical and a horizontal line.

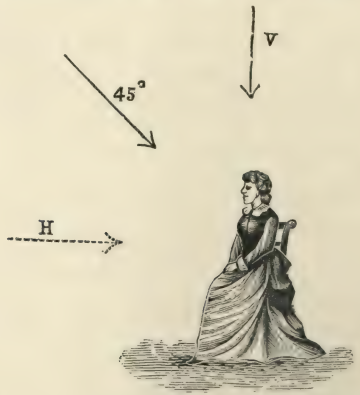

Fig. 15.—Position of sitter with respect to light. The principal light should fall at an angle of 45 degrees, midway between the vertical (V) and horizontal (H) lines.

The best idea of the light upon the face, etc., is got by viewing the sitter with the naked eye (use one eye only). This gives a truer impression than the image on the ground-glass. Always remember that the lights and shades will be

exaggerated by the gelatine dry-plate—the shadows will look blacker, and the high lights whiter, or, at least, more devoid of gradation than in nature.

116.—**Portraiture Out of Doors.**—In out-of-door work there is a possibility of doing what can scarcely be well done in an ordinary room—photographing the entire figure. This should not be attempted on a large scale, that is, the camera should not be placed too near the sitter. A place should be chosen facing the north, and where the top light can be prevented from falling vertically on the head. A house-porch, a tree with spreading branches, and well covered with leaves, an arbour, a coach-house with the folding doors fully open, a seat underneath a projecting building or balcony, a verandah, etc., etc., most of these places will answer capitally.

As the figure upon the ground-glass will not "fill" the picture if the camera is placed as recommended at a good distance from the sitter, it may be well to introduce one or two more figures (do not exceed three, if possible), and so make a "group" of it. A lens with a large stop (say $\frac{f}{16}$ or $\frac{f}{12}$) should be employed, and a rapid plate, which will admit of a short exposure being given (in good summer light say one second). Out-of-door portraits should always be taken in the shade—never in direct sunshine; a cloudy day is best for this work, but on a bright sunshiny day opportunity should be taken when the sun is behind a cloud to make the exposure.

117.—**Indoor Portraiture.**—Because a conservatory is a "glass-house," it is too often considered to possess all the properties of a studio. The fact is, that an ordinary conservatory lets in too much light, and lets it in *from every direction*.

A room with a lofty window, facing the north—if with a bow window, or with a glass door running right down to the floor, so much the better—will usually be found to answer well for indoor portraiture. If the window has Venetian blinds they should be removed if possible, as they block out some of the best light at the top. The glass of the window should be quite clean, or the top sash may be let down so as to be no obstruction to the light.

As a rule, it will be better in indoor portraiture not to attempt more than the head and shoulders of the sitter, or at most a "half-length." For one thing, it is difficult to get the camera far enough away from the sitter in an ordinary room to secure a "full-length"; and for another it is seldom possible to have the whole of the figure properly lighted. In this case (taking head and shoulders only), it may be well to block up the lower panes of the window by pinning a shawl or something opaque over them, so as to retain only the light which enters at the proper angle (45 degrees) from above.

For a first trial, place the camera close to one side of the window, and let the sitter be on the other side, about four feet from the window, and a little back into the room (see fig. 16.)

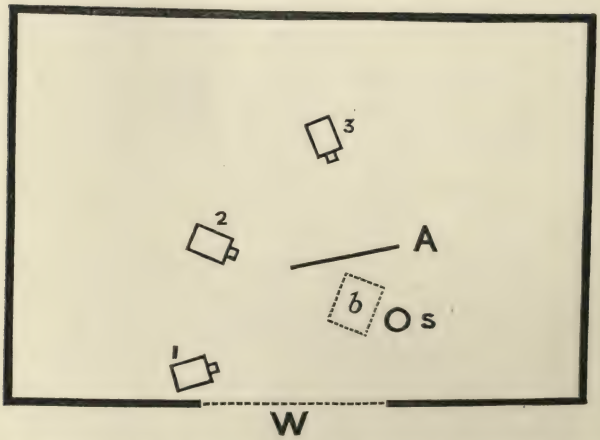

Fig. 16.—Portraiture in an ordinary room. W, window; S, sitter; 1, 2, 3, camera in three different positions; A, screen; B, newspaper laid on floor to reflect light upwards.

Next shift the camera to position (2), in each case letting the sitter look, not right into the lens, but at an object held about a foot on one side of it.

Finally place the camera in position (3), and let the sitter look towards the window. (In each case the screen must, of course, be shifted to suit the altered position.)

The first position will give a view of the full face fairly evenly lighted all over; in the second there will be some contrast between the side of the face turned toward the window and the other side; the third, or last, position will show a profile view chiefly of the shaded side of the face, giving what is known as the "Rembrandt" effect.

For indoor work a large stop may be used (say $\frac{f}{8}$), or the full aperture of the lens may be employed without any stop at all. When this is done an indiarubber ring should be slipped over the lens tube to prevent light from entering the diaphragm slit.

118.—**Times of Exposure in Rooms.**—With a rapid plate, good light, large window, etc., and lens working at $\frac{f}{8}$, a portrait in position (1) should not require more than two seconds, about half as much again in (2), and perhaps five or six seconds in position (3). It must be borne in mind, however, that these figures only represent the exposures for favourable conditions in the middle of the day (say 11 to 1); they should be doubled or trebled for a dull light, and doubled again for earlier or later hours. An over-exposed portrait can often be made something of, an under-exposed one is useless.

119.—**Use of Reflectors.**—To lighten the shadows on the side of the face which is turned away from the light, it is almost always necessary to use reflectors. These may consist of sheets of cardboard, or of white paper, or a white sheet. Throw the sheet over a screen or a clothes-horse, and bring it as near to the figure as possible without its encroaching on the field of view of the camera lens. Lay a sheet or two of white paper on the ground, so as to throw light upwards on the face, and thus lessen those black shadows under the eyes and nose which disfigure too many portraits. Sometimes a large looking-glass may be used with good effect as a reflector, but it should be kept in gentle motion during the exposure, or the effect may be "patchy."

120.—**Head-rests.**—Most people find it difficult to maintain the head in any given position for more than one or two seconds; some, indeed, find it impossible to "keep steady" even for that limited space of time; while, for all, the feeling of effort and restraint in trying to maintain their immobility tends to prevent their "looking pleasant."

A proper head-rest is a rather large, heavy and expensive piece of apparatus, but a lighter form is sold which can be screwed to the back of any chair. If it is a tall chair, the head may rest against the back; or, in an armchair, the

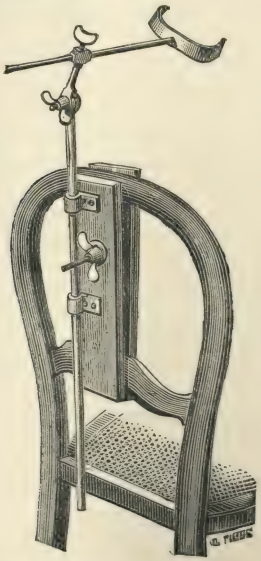

Fig. 17.—Portable head-rest, which can be fixed to the back of any chair.

head may be supported by the arm in a leaning position. It is certainly an advantage, both to the sitter and the photographer, to have the head supported in some way.

121.—**Posing the Sitter.**—To pose or place the sitter so that he or she shall appear to the best possible advantage requires much artistic talent and considerable

practice. It is curious, but true, that one side of the face (usually the left) is generally better looking than the other, and should be turned towards the lens. The eyes should always be turned in the same direction as the head, and the lens should not be below the level of the eyes. A good "home-made" pose for the male sex is to sit astride a chair with the arms leaning upon the back. The body should be kept fairly upright, but not stiff. Much may be learnt as to the "pose" by the study of good works of art—paintings, engravings, illustrated books, etc.

122.—**How the Sitter Should Dress.**—To begin with, the person who desires a pleasing portrait—especially if the whole figure is to be taken—should dress neither all in white nor all in black. A white dress usually comes out like a white mass or patch, void of detail. If it is relieved with plenty of lace and embroidery, and if a thin plate be used and a full exposure given, we sometimes secure very fine and striking results; but it requires the knowledge of the expert to do this. A dead heavy black is equally efficacious in hiding form and detail. Reds and yellows produce little more effect than black upon the sensitive plate, while blue and violet have so much power that they produce an impression nearly equal to white. Light greys and browns answer very well. Large patterns and checks are to be avoided, as they look very prominent and staring in the photograph. Black silk usually "takes" well, as its power of reflecting light diversifies its surface.

CHAPTER XIV.

Rapid Printing by Development on Bromide Paper.

123.—**What is Bromide Paper?**—Our ordinary ready-sensitised albumenised paper contains, as the substances sensitive to light, chloride and nitrate of silver. Within the last four or five years, however, another sensitive paper has been manufactured in which *bromide of silver* is the sensitive salt, and this is kept on the surface of the paper by means of gelatine; in fact, an emulsion or mixture of silver bromide and gelatine is prepared, and with this the paper is coated. But as bromide of silver is far more sensitive to light than chloride of silver, so this new paper must be guarded from white light with equal care to that with which we screen our dry plates, which indeed are coated with the same materials.

124.—**Two Kinds of Bromide Paper.**—Bromide paper is now made for two purposes. *Negative* bromide paper is for use in the camera, instead of glass plates; it is best employed in conjunction with a roll holder, and it has the advantage of lightness, unbreakability etc. But we advise the beginner to have nothing to do with negative paper or films until he has mastered photography on glass. We believe, also, that the *best* results are always obtainable on the rigid material.

Positive bromide paper is not quite so sensitive to light as that prepared for "negative" purposes, but it will certainly be spoiled by a single ray of direct white light. It is usually sold ready cut to the size of plate required.

125.—**Printing by Development.**—The only mode of "development" printing to which we intend to allude here is that in which the bromide paper is placed *in contact* with the negative, and is then exposed for a few seconds to a gas flame (or for a still shorter period of time

to daylight). It is then removed from the printing-frame and "developed" by pouring on it a solution which acts in the same way as upon an ordinary dry plate, the difference being that as the print is made from a negative, it is itself a true or "positive" copy of the original object. The bromide print is then fixed, washed, dried, and mounted in the usual way. It requires no toning. This method is especially useful in the dull days of winter, when silver prints cannot be obtained with sufficient rapidity. It is also handy when a print is desired from a negative in a hurry. It is indeed possible to expose a plate, develop, fix and dry it, and take a contact print therefrom on bromide paper in but little more than half-an-hour.

126.—**Materials for Printing by Development.**—We require, practically, the same dark room, ruby lamp, dishes, water, etc., as for ordinary negative work. All the dishes must be perfectly clean. It is a mistake to suppose that a dish or measure can be cleansed by repeated rinsings with water; friction is also necessary, and should be applied by means of a soft brush or a cloth. It is also a good plan to clean such articles occasionally with dilute nitric or hydrochloric acid (one of acid to ten of water).

127.—**The Ferrous Oxalate Developer.**—The developer we employed for our *negatives* had pyrogallic acid for its principal ingredient; this is apt to stain, or at all events to tint the bromide paper now to be used, so that we replace it by a developer known as ferrous oxalate, which leaves the "whites" of the paper quite clear, or at all events is an improvement in this respect on the pyro.

To make the ferrous oxalate developer, we place half-a-pound of neutral potassium oxalate in a half-pint bottle and fill it up with warm distilled water. On shaking, the greater part of the white crystals will dissolve, forming what chemists call a saturated solution. This solution ought to be *just* on the acid side of neutrality, *i.e.*, it ought very slowly to turn a piece of blue litmus paper to a pale red. If it does not do this, a small crystal or two of oxalic or of citric acid must be dissolved in it, and the liquid then tested again.

In a second bottle of smaller size, say a six-ounce bottle, place a quarter of a pound of clear green crystals of ferrous sulphate (sulphate of iron or green vitriol), and fill the bottle up with distilled water, adding five drops of sulphuric acid. Fill the bottle up with distilled water every time it is used, adding a few drops of sulphuric acid occasionally. If a few inches of iron wire are also kept in the bottle, and it has a good ground-glass stopper, the solution will keep good for months. This will be a saturated solution of sulphate of iron. As long as it retains its green colour it is all right, but when it turns yellow, as it will do with keeping, it is useless. As these two solutions become used up more water may be added until the crystals at the bottom are nearly all dissolved. When this happens, fresh quantities of potash oxalate and ferrous sulphate must be placed in the bottles.

To make up the developer—for, say, half-plate prints—measure out three ounces of the oxalate solution, and add to it half an ounce of the sulphate of iron solution, and four or five drops of the ten per cent. solution of ammonium bromide already prepared for negative work. The iron must always *be added to* the potash oxalate solution, and not *vice versâ*. All bottles containing solutions should be very boldly labelled, and it is a good plan to have them of different sizes and shapes, so as to be readily distinguished in the dull light of the dark room.

This ferrous oxalate developer can also be used for ordinary negative dry plate work. It does not, however, allow of so much latitude in exposure as the pyro-ammonia developer.

128.—**Contact Printing by Development: Exposure.**—Place the negative in a printing-frame, and put a piece of bromide paper in contact with it, film to film. The film side of the paper can always be distinguished by the paper curling in towards that side. This must, of course, be done in non-actinic light—either red or orange-yellow. Now for the exposure: always use artificial light, and always have the gas-jet or lamp-flame which you employ as nearly of the same intensity as possible. Turn the gas down to the "blue," place one end

of a two-foot rule touching the burner, and let the bottom of the printing-frame touch the other end. Now turn up the gas and expose—for how long? Well, that must be according to the quality of the negative. For a thin negative five seconds only may be sufficient; for a dense one about forty. If it is a large negative it may be well to make a trial exposure with a strip of the bromide paper only, so as to save wasting the whole piece. Once the right time of exposure is ascertained, enter it in your catalogue of negatives, and it will serve for all future prints from that particular negative.

129.—**How to Develop Contact Prints.**—Having given the proper exposure, undo the printing-frame, take out the print and soak it well in clean water till it is quite limp. Now place it, film side upward, in a clean developing dish, and pour the ferrous oxalate solution over it. Rock the dish, and see that every part of the print is evenly covered by the solution. The image should appear very gradually; if the picture comes "with a rush," all at once, it is a sign of over-exposure; try half the exposure for the next print. Under-exposure is known by the reluctance of the image to appear, by the black and white ("soot and whitewash" as it has been called) appearance of the print, and by refusal of the details in the shadows to appear at all. In the latter case we may cautiously add a little more of the ferrous sulphate solution to the developer, but the proportion of this to the potassium oxalate must never exceed one-fourth, or the developer will become muddy, yellow and useless.

Another plan which may be tried as a last resource to bring out the detail is to add four or five drops of fresh hypo solution (as prepared for fixing negatives) to the developer.

If all goes well, the development will be completed in five or six minutes, and the picture should then look just as you desire it to be when finished.

The print must then be removed from the developing-dish, and soaked for five minutes in a solution of acetic acid (one dram glacial acetic acid to a quart of water). This will clear it of the iron, which would stain the paper

if it were removed directly from the developer to clean water. After the acid bath, or "clearer," the bromide print must be well washed in two or three changes of fresh water, to remove the acid solution. If one of these waters is made just alkaline by the addition of a little washing-soda this object will be effected all the more quickly.

130.—**Fixing Bromide Prints.**—The fixing bath for bromide prints may be of the same strength as for those on ordinary albumenised paper, viz., two ounces of hypo to a pint of water. This quantity will fix three or four dozen quarter-plate prints, and may afterwards be kept for fixing negatives. Keep the prints in frequent motion in the fixing bath for about twenty minutes.

131.—**Washing Bromide Prints.**—Remove the prints from the fixing bath to a large dish of clean water, and rinse them well in four or five changes of fresh water. Then wash in running water for an hour at least.

132.—**Final Clearing Bath for Bromide Prints.**—It will improve the whites of the prints to give them a soaking for five minutes at this stage in a solution of water one pint, sulphuric acid half-an-ounce; after this the prints must be washed for at least another hour (better two hours) in water which is continually changing.

133.—**Drying and Mounting Bromide Prints.**—A beautiful glossy surface can be given to bromide prints by squeegeeing them while wet, film downwards, upon the surface of a plate of polished vulcanite or a ferrotype plate (enamelled iron), or upon plate glass which has been lightly rubbed over with talc by means of a pad of cotton wool. The prints must be left to dry in a warm, dry place, and in a few hours they should readily peel off the polished surface with a fine polish. For large prints, however, this gloss is considered inartistic. To get a dull or matt surface the prints may be squeegeed on any hard level surface with the film side up. The best squeegee for this purpose is a piece of thick indiarubber tubing, in which has been slipped a rod of glass or hard wood. By *rolling* this squeegee over the back of the print the moisture is quickly expelled, and the print is caused to adhere to the vulcanite, etc. Bromide

prints must not be dried between sheets of blotting-paper, as is the custom with silver prints. The gelatine adheres to the blotting-paper, and the prints would have to be wetted again to get rid of it.

Finally, the prints may be mounted in the same way as ordinary silver prints (see Chapter X.); they look best behind a cut-out mount, and when good are often difficult to distinguish from a fine etching or engraving.

CHAPTER XV.

Printing Positives on Glass for the Lantern.

134.—**Lantern Slide Making.**—One of the most pleasant occupations for the photographer during the winter evenings is the preparation of lantern slides from his own or his friends' negatives. A good picture is never seen to such advantage as when magnified upon the screen; indeed, it is then sometimes difficult not to think that we are gazing upon the scene itself. Never paint your lantern slides; with rare exceptions, a photograph painted is a photograph spoiled.

135.—**Materials for Lantern Slides.**—First we require some sensitive plates. These should measure $3\frac{1}{4}$ inches each way. Several plate-makers manufacture a special plate for this work. It should be coated with a slow emulsion. Gelatino-chloride plates give good results, and a wide variety of tones can be got with them from red to black. We shall require the usual dark-room apparatus, developing dishes, etc., and the best developer is the ferrous oxalate as employed for bromide prints, but double the usual quantity of "restrainer" (*i.e.*, ammonium bromide) may be added, as it is very important to keep the shadows clear. Plates of thin clear glass ("cover-glasses") three-and-a-quarter inches square will also be needed, and some gummed strips of black or brown needle-paper to bind each cover-glass to the slide which it is to protect. "Masks" are also necessary. These are pieces of thin opaque black paper, $3\frac{1}{4}$ inches square, cut in the middle with a circular or cushion-shaped opening usually three inches in diameter. They are placed between the lantern slide and the cover-glass, and give a neat and sharp border to each picture, so that it has a finished appearance.

136.—**Manipulations in Lantern Slide Making.**—Place the negative in a printing-frame, and the sensitive plate upon it, film to film; each should first be carefully dusted with a camel-hair brush. Hold the frame up between the eye and the dark-room lamp, and adjust the plate until it covers the desired part of the negative. Then fasten the two together by putting on the back of the printing-frame.

Hints on the time of exposure will usually be found in the printed instructions which accompany each packet of plates, but about 15 seconds at a distance of two feet from an ordinary gas-burner may be taken as the average for gelatino-bromide plates.

137.—**Development of Lantern Slides.**—All the dishes must be perfectly clean, and all the solutions used must be fresh. Remove the exposed plate from the printing-frame, and place it, film up, in the developing-dish. Cover it with the ferrous oxalate developer (see par. 127), and pass a brush over the film to remove air bubbles; rock the dish. The picture should appear in about two minutes. The degree of intensity which the picture should be allowed to obtain must depend partly on the light with which it is to be shown on the screen. The oxy-hydrogen lime-light, for example, will require a darker and more brilliant transparency than the oil-lantern. There must be no "veil" or deposit over the "high lights;" indeed, there ought to be a little perfectly clear glass. An extra dose of ammonium bromide will do good in this respect.

138.—**Fixing and Clearing of Lantern Slides.**—After development is complete rinse the plate thoroughly in fresh water, and immerse it in a clean hypo bath (four ounces of hypo to the pint of water) for fifteen or twenty minutes. Then wash well for an hour. Next give the plate a soaking for a minute or two in the clearing and hardening solution (see paragraph 56), and finally wash again for three or four hours. Then stand the plates to dry in a warm room on a clean piece of blotting-paper with the film side facing the wall.

139.—**Mounting Lantern Slides.**—When the slide is dry clean the back thoroughly, dust the film, place a mask of suitable shape in contact with it, and upon the top edge of this a strip of white paper bearing the name of the picture, so that when the picture is laid face upward in its natural position the name of the picture will be seen on the upper margin of the mask. Upon the mask lay a clean thin cover-glass. Wet some gummed strips of needle-paper and bind the edges of the two glass plates together. Finally, place the plates under a pressure of two or three pounds, and leave to dry.

Lantern slides are best stored in grooved boxes, which should hold sixty each.

CHAPTER XVI.

Printing with Iron and with Platinum.

I.—IRON.

140.—**Cyanotype, or the "Blue Process."**—In 1842 Sir John Herschel announced his discovery of the fact that many of the salts of iron were affected by light. Of the many compounds containing iron which he tried he found the ammonia-citrate of iron to be most convenient, and subsequent research has confirmed his judgment. This is a reddish-brown substance, which can be bought at any chemist's for threepence per ounce. The action of light upon the iron salt is made visible by the use of potassium ferridcyanide (red prussiate of potash), sixpence per ounce, which is a red solid that when exposed to air becomes covered with a yellowish crust. This crust should be washed off by rinsing in water before the substance is used.

141.—**Preparation of Cyanotype Paper.**—Although cyanotype paper can be bought ready prepared it is well to know how it is made, and, moreover, much better prints can be obtained when the paper is quite fresh.

Make up the following two solutions:—

(A)	Citrate of iron and ammonium	3 ounces.
	Distilled water	12 ,,
(B)	Red prussiate of potash	3 ounces.
	Distilled water	12 ,,

Keep these solutions in separate bottles, having brown paper pasted round them to protect the contents from the light.

The paper to be coated should be thin and well sized. A white smooth-surfaced drawing-paper answers well.

Mix the solutions *A* and *B* in equal parts in a clean dish, and add a few drops—say, five for each ounce—of your ten per cent. solution of ammonium bromide. Cut the paper to the size of your negatives, and soak each piece in the mixture for two or three minutes. This operation must be performed in a very subdued light, as the liquid is sensitive to light. The paper may be floated on the liquid, if preferred, or the latter may be applied to the paper with a flat brush or a sponge. In removing the sheets of paper draw them over the edge of the dish, or over a glass rod, to remove the excess of the liquid.

Lastly, dry the paper in the dark, and put it by till wanted. Such paper works best when used within a few hours, but it will retain its sensitiveness for days or even weeks.

142.—**Printing with Cyanotype Paper.**—For use the cyanotype paper is placed in contact with the negative in the usual way, and exposed to daylight until the shadows (corresponding to the clear parts of the negative) have a bronzed appearance. This requires about three times as long as for a silver print. The paper print is then washed—first in water to which a little citric or hydrochloric acid has been added (just enough to make it taste sour), and afterwards in plenty of plain water. The final result will be a picture in bright blue lines upon a white ground.

143.—**Chemical Action of Light upon Cyanotype Paper.**—The blue is really a kind of insoluble Prussian blue, due to the combination of that part of the iron salt which has been affected by light with the ferridcyanide of potassium. Where the iron has been protected from the light (as by the "high lights" or dark parts of the negative) no such combination takes place, the substances are soluble, and are washed away, leaving the white surface of the paper exposed. Thus we get a positive print from a negative.

144.—**Encaustic Paste.**—By rubbing the surface of a dry "blue print" with some *encaustic paste*, which can be purchased at the shops, or made by rubbing up white wax with an equal weight of turpentine, a brilliant surface

can be imparted. The paste should be applied on flannel, and a second piece of clean, dry flannel should be used as a polisher. This preparation will also serve for ordinary prints on albumenised paper.

145.—**Use of Cyanotype by Engineers, etc.**—This blue process is used on a large scale to reproduce mechanical drawings, etc., and any drawing or engraving can be copied by its aid. In such cases, as we are working from a positive impression, we get a negative copy, consisting of white lines on a blue ground. Note that the sensitive paper must be applied to the *back* of the tracing or drawing, or the copy will be reversed.

146.—**Toning Blue Prints.**—Blue prints can be altered in tone by treatment in various ways after washing, and this opens an interesting field for experiment. By soaking in a weak solution of sulphuric acid (1 to 100) they can be changed to a bluish green; a weak ammonia solution gives lilac tones (not permanent); immersion for five minutes in tannic acid one dram, water four ounces, followed by one minute in carbonate of soda one dram, water eight ounces, finishing off with the tannic acid bath again, gives red to black tones.

As a simple, easy method of printing, cyanotype deserves more attention than it has hitherto received. It is much more practised in America than in England. With sea-scapes the results are especially pleasing.

II.—PLATINUM.

147.—**The Platinotype Process.**—Metallic platinum is one of the most unalterable metals in existence. It is impossible to melt it by ordinary means; and it is unaffected by air, light, moisture, and by most chemicals. Finely-divided platinum is quite black, and it is evident that pictures composed of such a substance must be at least as permanent as the paper upon which they are printed. The process by which positive copies or prints of photographic negatives are now secured in "platinum black" was discovered by Mr. W. Willis, jun., in 1873; and his patents for it are worked by the Platinotype Co., 29,

Southampton Row, High Holborn, London, W.C., from whom the materials must be purchased.

148.—**Materials Required for Platinotype.**—The paper is best bought ready-coated from the company; it must be kept in an air-tight tin case, having a false bottom, in which is placed some calcium chloride. This chemical greedily absorbs moisture, and so the air inside the case is kept perfectly dry. An enamelled iron dish will be needed, a little larger than the negatives which are being printed from; some sheets of thin indiarubber cloth the size of the negative; and three or four porcelain dishes in which to wash the prints.

149.—**How to Print Platinotypes.**—Everything must be perfectly *dry;* any moisture causes the resulting print to be of a slaty hue instead of a rich black. Select vigorous negatives, dense and possessing good contrasts. Place the varnished negative in a printing-frame, and put a piece of the platinotype paper in contact with it, sensitive side next the film. Cover the paper with a sheet of indiarubber, and over this put a dry pad of felt, and finally close the back.

In the ordinary platinotype process beginners find a difficulty in knowing how long to expose the negative to daylight. The paper is more sensitive than ordinary albumenised sensitive paper, but the only *visible* change effected in it by light is the production of a pale brownish or orange-coloured image, in which the details are barely discernible.

150.—**Development of Platinotypes.**—Make a saturated solution of neutral potash oxalate, and add to it just enough oxalic acid to turn blue litmus paper pink. Place this in the enamelled iron dish (the depth of the solution should not be less than half-an-inch) and heat it 180° F. as tested by a thermometer.

The exposed prints must be gently laid picture downwards upon the surface of the hot solution, and allowed to remain there for from five to ten seconds. Development is completed very rapidly, and the prints must be removed immediately it is judged to be complete. For over-exposed prints the solution should be twenty degrees cooler, and for

under-exposed ones it may be made as much hotter. The heat is best supplied by using gas in a Bunsen burner underneath the iron dish, which should be supported on an iron tripod.

151.—**Clearing of Platinotypes.**—Platinotype prints require no toning. They are cleared by washing them in at least three changes of acidulated water (hydrochloric acid one ounce, water three pints), and afterwards washing well in plain water for ten minutes.

152.—**Chemistry of the Platinotype Process.**—The paper is coated with a mixture of ferric oxalate and chloro-platinite of potassium. On exposure to light the *ferric* is reduced to *ferrous* oxalate. Now, when this latter substance—ferrous oxalate—is *in solution* it attacks the platinum salt, reducing it to black metallic platinum. This solution is effected by the developing liquid, hot potash oxalate. The process is thus simplicity itself, and when we consider the artistic beauty of the resulting prints—which look exactly like fine engravings—it is surprising that it is not more practised.

153.—**Recent Improvements in Platinotype.**—Mr. Willis has lately introduced a modification of his process by which the platinum salt is put in the developing bath instead of upon the paper. This enables the bath to be used *cold*, in consequence of which development is much slower, and it can be watched and judged with greater ease.

In another process—due to the Austrian investigator, Capt. Pizzighelli—the picture is printed right out on the sensitised paper, just as with silver paper. It consequently requires no development at all, and the print has simply to be washed—first in water containing a little hydrochloric acid, and then in plain water for ten minutes—and dried.

Each method has its advantages, and those who have time to experiment should try all three.

154.—**Conclusion.**—And now we have come to the end of the "straight road" along which we promised to conduct the beginner in photography. We have laid down the main principles which are necessary to success, and for the beginner there should be *no experimenting*—let him

learn to walk before he essays to run a race. Adhere strictly to the methods we have laid down, and with *practice* your ultimate success is certain.

Perhaps one more word of practical advice may be given. Ascertain from some competent friend or authority the make of dry-plate which he uses; adopt that make, and confine yourself to it exclusively. It may be said that all the principal makes of plates now in use are good *when we know their peculiarities;* and by adhering to the use of one make these peculiarities can soon be mastered.

Failures the young photographer will be certain to have; but these should not discourage him.

At this moment photography presents the most attractive and promising field for research of all the sciences; and it is steadily but surely influencing art.

Many think that the limit of its possibilities has been nearly attained; but that is far from being the belief of the author of this book. When photography celebrates the first century of its existence, in 1939, we believe that the advance upon the knowledge of to-day will be as great as the progress which has been made during the fifty years just ended.

THE END.

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